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ABSTRACT

This dissertation reviews the literature on creative behavior and reports a study exploring the operational approach to creativity. One hundred and nineteen 6th-grade students were assigned randomly to 6 treatment levels. The Ss in 4 levels read booklets which described principles of creative thinking techniques, and which presented examples and exercises. One group read a control booklet, while another read no booklet. All Ss then completed 3 creativity tests and an attitude inventory. Hypotheses predicted differences among treatment levels as a function of the playfulness or organizational emphasis of the various techniques. The more playful techniques (e.g., Personal Analogy) were expected to produce higher scores on measures of Flexibility, Originality, and Best Ideas. The more organized techniques (e.g., Part Changing) were expected to produce higher scores on Fluency. No treatment differences were found, however, for any of the dependent measures, nor were there differences in the Treatment x Sex or Treatment x School interactions. Covariate (IQ & Language scores) adjustments increased some treatment effects while decreasing their relatively large standard errors. (Author)

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CREATIVE THINKING TECHNIQUES: FOUR METHODS OF STIMULATING ORIGINAL IDEAS IN SIXTH GRADE STUDENTS

Report from the Task and Training Variables in Human Problem Solving and Creative Thinking Project

By Thomas F. Warren

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Wisconsin Research and Development
Center for Cognitive Learning
The University of Wisconsin
Madison, Wisconsin

September 1971

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STATEMENT OF FOCUS

The Wisconsin Research and Development Center for Cognitive Learning focuses on contributing to a better understanding of cognitive learning by children and youth and to the improvement of related educational practices. The strategy for research and development is comprehensive. It includes basic research to generate new knowledge about the conditions and processes of learning and about the processes of instruction, and the subsequent development of research-based instructional materials, many of which are designed for use by teachers and others for use by students. These materials are tested and refined in school settings. Through these operations behavioral scientists, curriculum experts, academic scholars, and school people interact, insuring that the results of Center activities are based soundly on knowledge of subject matter and cognitive learning and that they are applied to the improvement of educational practice.

This Technical Report is from the Task and Training Variables in Human Problem Solving and Creative Thinking Project in Program 1. General objectives of the Program are to generate new knowledge about concept learning and cognitive skills, to synthesize existing knowledge, and to develop educational materials suggested by the prior activities. Contributing to these Program objectives, this project is focused on investigating creative problem solving as a trainable cognitive skill. The development and testing of creative thinking programs follows research on basic problem-solving variables in different situations.

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ABSTRACT

This dissertation reviews the literature on creative behavior and reports the results of a study in which the operational approach to creativity was explored.

Each of 119 sixth-grade students was assigned randomly to one of six treatment levels. The Ss in four levels read booklets which described principles of creative thinking techniques, along with presenting examples and exercises. One group read a control booklet, while another read no booklet. Following this, all Ss completed three creativity tests and an attitude inventory. Hypotheses predicted differences among treatment levels as a function of the playfulness or organizational emphasis of the various techniques. The more playful techniques (e.g., Personal Analogy) were expected to produce higher scores on measures of Flexibility, Originality, and Best Ideas. The more organized techniques (e.g., Part Changing) were expected to produce higher scores on Fluency. No hypotheses were made regarding a convergent association measure, the Warren and Davis Distant Linking Exam.

Results did not support these hypotheses. No treatment differences were found for any of the dependent measures, nor were there differences in the Treatment x Sex or Treatment x School interactions. Covariate (IQ & Language scores) adjustments tended to increase some treatment effects slightly while decreasing their standard errors. For all measures, treatment effects were small relative to their standard errors, before and after covariate adjustment.

Chapter I

INTRODUCTION

Over the years, several general approaches or orientations to the investigation and conceptualization of creativity have evolved. One is an attempt to learn about the traits, abilities and personality of the creative individual. Ann Roe's (1952) study of scientists and the Barron (e.g., 1955, 1957, 1968), MacKinnon (e.g., 1960a, 1960b, 1961, 1962, 1969), and Helson (e.g., 1967, 1968) studies of creative writers, engineers, architects, mathematicians, and college students at the Institute for Personality Assessment and Research are in this tradition.

Another way to study creative behavior is to examine the ruminations of innovative people when they voluntarily discuss the processes by which they create. Such eminent individuals as Henry Moore, D. H. Lawrence, Edgar Allen Poe, Henri Poincare (all cited in Fabun, 1968), Ernest Hemingway (1964), and Thomas Wolfe (1936) have sought to describe their own ways of creating.

Another approach is the investigation of intellectual qualities through multivariate methods of factor analysis. Guilford and his associates (e.g., Guilford, 1950, 1956, 1957, 1959, 1961, 1967; Guilford, Christensen, Frick & Merrifield, 1961; Guilford & Hoepfner, 1966; Guilford, Merrifield, Christensen & Frick, 1961) have been

the most active and productive in this area.

A fourth viewpoint, psychoanalysis, utilizes clinical sources (e.g., Bowers, 1965) and projective measures (e.g., Pogue, 1964) to study a concept of creativity that is based on the Freudian idea of supressed libidinal energy (e.g., Brill, 1938).

Researchers such as Maltzman (e.g., 1960), Mednick (e.g., 1962), and Staats (e.g., 1968) are a few who work within a behavioristic orientation, extending theories and methods of experimental psychology to the study of originality and problem solving.

A sixth approach, which is sometimes derived from the other approaches, involves identifying steps and stages in the creative process (e.g., preparation, incubation, illumination, and verification). McPherson (1968) itemized 18 different lists of this kind without going back to the ancient Greeks or Francis Bacon.

Finally, there is the operational approach. Creativity is defined by reference to tasks and techniques which elicit or "teach" methods for producing new and useful ideas. Gordon (1961, 1969), Osborn (1963), Parnes (1962a, 1962b), and Crawford (1954) have been most active in initiating the development of industrial and professional creative thinking programs which are just beginning to be appreciated and studied by educational scientists.

The research to be reported in this dissertation has its origin more in the operational tradition than in any other. More specifically, four training booklets were written, each presenting a particular creative thinking technique. Each sixth grade student studied one of the booklets for about one hour, then responded to

three creativity "tests," and an attitude inventory. Two control groups, one which read a story-completion booklet and one which did not, also completed the creativity tests and the attitude survey.

Chapter II

REVIEW OF THE LITERATURE

Two Pervasive Undercurrents

Regardless of which methodological or conceptual approach is preferred, creativity seems to involve two ostensibly opposed characteristics. On the one hand is something akin to organization, lawfulness, predictability, order, planning, nurture, and science. On the other, one finds play, fantasy, intuition, mystery, nature, and art. Bruner (1962) was talking about a similar dichotomy in his "right and left hand" analogy. The right hand is lawfulness, order, geometry, and taut implication; the left is sentiment, fantasy, and intuition. Hunches are sometimes tamed by shifting them from the left hand to the right hand.

In assessing the historical development of creativity conceptualization, Gordon (1961) also alluded to two quite different factors.

> The traditional nineteenth century romantic view of the nature of creativity places heavy emphasis on the fine arts and poetry as the 'only' creative enterprise, and asserts the primacy of individual genius in such a way that all human creative experience is hustled into the dark limbo of personal mystery. The common-sense twentieth century view of the creative process has become complicated by insistence on some method of measurement. How can we test for the mysterious quality of 'creativity?' How can we single out the creative individual in the democratic mass? How can we train individuals to become creative in the complex societies which we call education

> or industry? In other words, the twentieth century view of creativity is bifurcated into, on the one hand, a mysterious personal element that cannot be understood and, on the other hand, a quality that may be tested for and taught to anyone (Gordon, 1961, p. 8).

A related question that arises when dealing with operationalized or "forced" creativity (i.e., using idea-generating techniques such as brainstorming) involves their relationship to intuitive/primary/natural creativity. One might ask, "Is this 'artificial' creativity equivalent to 'the real thing?'" A final answer is not available since too little research has been done to make a definitive statement. Several investigators, however, do give qualified support for the idea that much similarity exists between the two realms. For instance, Mason (1960) and Arnold (1962) felt that training in conscious, learnable creative thinking techniques will result in increased intuitive creativity. Conscious effort will stimulate, awaken and strengthen one's creative potential. Osborn (1963) and Parnes (1962a) agreed that techniques may very likely be a first step to utilizing one's creative potential. Davis, Manske, and Train (1967) noted that many creative thinking techniques were first suggested by very creative people. It may be that their own "natural creativity" is well represented in the operationalized processes that are currently being taught in college and professional creative problem solving courses.

Techniques: A Rationale for Their Existence

Bruner (1964) takes a strong stand in arguing for the important role of techniques in the development of intelligence.

> . . . the development of human intellectual functioning from infancy to such perfection as it may reach is shaped by a series of technological advances in the use of mind. Growth depends upon the mastery of techniques and cannot be understood without reference to such mastery. These techniques are not, in the main, inventions of the individuals who are 'growing up'; they are rather skills transmitted with varying efficiency and success by the culture . . . (p. 1).

Bruner goes so far as to suggest that the principle evolutionary change in man "has been alloplastic rather than autoplastic. That is to say, he has changed by linking himself with new, external implementation systems rather than by any conspicuous change in morphology . . ." (p. 1).

Referring specifically to creative intelligence, Guilford (1962) suggested

> Like most behavior, creative activity probably represents to some extent many learned skills. There may be limitations set on these skills by heredity; but I am convinced that through learning one can extend the skills within these limitations (p. 188).

Davis (1969) noted the teachable nature of creative attitudes, abilities and techniques. Attitudes may be defined as "learned, emotionally toned predispositions to react consistently, favorably or unfavorably, toward persons, objects or ideas" (Klausmeier & Goodwin, 1966, p. 343). A positive attitude toward novel ideas is important to creative development, and several creative thinking programs and strategies purposely seek to develop such attitudes, e.g., Osborn's (1963) brainstorming; Covington, Crutchfield, and Davies' (1966) Productive Thinking Program; Meyers and Torrance's (1964, 1965a, 1965b, 1966a, 1966b) Idea Books, and Davis and Houtman's (1968) Thinking Creatively. Although creative abilities usually are

thought of as unlearned, according to Guilford (1962) they possibly can be strengthened. He suggested giving Ss exercises similar to the tests used to measure creative ability. Practice in such basic abilities as remembering, free-associating, discerning problems, being original and flexible, perceiving relationships, imagining and elaborating on wild ideas, plus others is provided in the Myers and Torrance Idea Books and in the Covington, Crutchfield, and Davies program.

Creative thinking techniques are "conscious and deliberate procedures for producing new combinations of ideas" (Davis, 1969, p. 540). Such techniques as attribute listing, morphological synthesis, checklisting and synectics have formed the core of several industry-related creative thinking programs. Davis, Manske, and Train (1967, p. 2) commented, "In knowledgeable commercial circles, the psychological-philosophical question 'Can creativity really be increased?' probably would evoke some condescending smirks." Davis, Manske, and Train also noted that although industry, psychology, and education have different goals, they define creativity in a relatively uniform way. "An idea is creative if it is both original (unusual, unique), and somehow potentially useful (practical, feasible) . . . New and creative ideas are typically the product of combining two or more previously unrelated ideas" (p. 1).

Techniques: Discriptions and Research

While systematic laboratory research with creative thinking techniques has been deplorably minimal (Warren & Davis, 1969),

there are in fact several historical antecedents to present techniques, dating back as early as 1898.

Nonsense Figures.--Royce (1898) asked Ss to draw some nonsense figures different from anything they had ever seen. He compared these drawings with a second set resulting from instructions to draw figures as different as possible from some model drawings presented. He concluded that such a technique may aid originality.

Stories as Springboards.--Slossen and Downey (1922) proposed a technique that involved writing stories or passages based on unusual newspaper articles or ads. The articles and ads served as springboards to literary originality. The authors suggested testing originality by seeing how many different plots could be suggested for the same article or ad.

Attribute Listing.--Attribute listing is a technique popularized by Robert P. Crawford in Techniques of Creative Thinking (1954). Crawford was actively involved in using techniques long before the fifties, however, having started teaching courses in creative thinking at the University of Nebraska as early as 1931. He defines his attribute listing technique succinctly by saying, "Each time we take a creative problem solving step we do it by changing an attribute or quality of something, or else by applying that same attribute to some other thing" (1954, p. 96). "Thing" here is broadly conceived, including technological, literary, musical, and artistic materials. And again

> Being original is simply reaching over and shifting attributes in what is before you (p. 52). The process

> of creation is so simple and easy, when one understands it, that even the best of things is usually susceptible of improvement (p. 96).

Attribute listing is an organized, straightforward technique for implementing change. However, "purists" with other creativity viewpoints may not agree with Crawford's simplistic description nor his confidence.

Brainstorming.--Brainstorming is a technique especially suited for group participation. It was conceived and developed by Alex Osborn in the late 1930's, and has been a household word among businessmen and industrialists since the early fifties. Many corporations conduct classes which teach the rudiments of brainstorming. It is also taught at the Creative Education Foundation's annual workshop in Buffalo, New York, and occupies a prominent place in Davis and Houtman's (1968) book. Brainstorming sessions have long- and short-term goals. The long-term goal is the solution of an important problem. In the short run, however, the goal is production of a large number of ideas which may have potential value as solutions. Osborn (1963, p. 156) lists four basic ground rules of brainstorming:

(1) Criticism is ruled out. Adverse judgment of ideas must be withheld until later.

(2) 'Free Wheeling' is welcomed. The wilder the idea, the better; it is easier to tame down than to think up.

(3) Quantity is wanted. The greater the number of ideas, the more the likelihood of useful ideas.

(4) Combination and improvement are sought. In addition to contributing ideas of their own, participants

> suggest how ideas of others can be turned into better ideas; or how two or more ideas can be joined into still another idea.

Several suggestions, stemming from years of experience with brainstorming, are considered important to Osborn. They involve group size (optimal = 10-12), group roles (a leader, associate leader, five regular members, and five guests), group skill qualifications (heterogeneity regarding training and experience; homogeneity with respect to rank), procedure (participants should be aware of the problem to be discussed 48 hours before the session so they can think about it; the session should last only 30-45 minutes), and follow-up (participants' post-session ideas are often good ones and should be solicited).

The most important yardstick of brainstorming's success has been its wide acceptance as a useful idea generating tool. As with other techniques growing out of industry (e.g., synectics) laboratory evaluations of brainstorming have not been plentiful, but comments and testimonials from industry have. Osborn (1963), Clark (1958), and Mason (1960) all report "successful" brainstorming sessions involving such corporations as GE, GM, RCA, IBM and others. Davis, Manske, and Train (1967) noted that although some evidence exists showing that individuals are more productive when alone than in groups (e.g., Bass, 1959; Dunnette, 1964; Dunnette, Campbell, & Jaastad, 1963; Taylor, Berry & Block, 1958; and Zagona, Willis & MacKinnon, 1966), and that evaluation during idea production is more effective than the deferred-judgment brainstorming sessions (Weisskopf-Joelson & Elisea, 1961), "these studies might best be

considered as having relevance mainly to the particular experimental conditions, rather than somehow 'disproving' brainstorming" (p. 3).

Variations on the basic theme have included: Stop-and-Go-Brainstorming in which a group occasionally stops producing ideas and evaluates their production to see if they are still "on target" (Mason, 1960); Reverse Brainstorming in which a list of criticisms of a particular idea is attacked and hopefully destroyed (Mason, 1960); and the "Phillips 66" technique for use with large groups. After the problem is understood, small groups of six individuals brainstorm for six minutes after which a report is given to the leader (mentioned in Davis, 1971).

Synectics.--Several techniques may be classified under the heading of synectics. The word is derived from the Greek synecticos which means "the joining together of different and apparently irrelevant elements" (Gordon, 1961, p. 3). The conscious use of metaphor is a key to the synectics process. Aristotle (Poetics, in Butcher, 1951, translation) noted that artists recognize the value of "giving a thing a name that belongs to something else." Gordon extends this process and maintains that metaphorical thinking can be taught.

After more than 20 years of experience with teaching and refining metaphor-based creativity concepts, Gordon (1969) stated:

> . . . the most important element in the creative process is Making the Familiar Strange, because scientific breakthroughs as well as visual and literary innovations depend on strange new contexts by which to view a familiar world (p. 3).

Gordon described three operational mechanisms, each metaphorical in character, for Making the Familiar Strange, all of which provide a non-rational, playful, stimulating atmosphere. They are Direct Analogy, Personal Analogy, and Compressed Conflict. "Direct Analogy is a simple comparison of two objects or concepts" (Gordon, 1969, p. 16). English teachers might include "metaphor" and "simile" under the rubric of Direct Analogy, e.g., "The wind-blown sand bit at our faces," "The wall was rough as a gardener's hand," respectively. Gordon noted many examples of how Direct Analogy stimulated discovery in science.

> Brunel developed the concept of the caisson by noting the boring capacity of the toredo, a ship worm. Alexander Graham Bell used Direct Analogy to develop the telephone receiver. His telephone notion was derived from the function of the tiny bones of the ear. Many basic nuclear theories are a clear comparison with an astronomy model (p. 17).

The more "constructive strain" (i.e., distance, or lack of obvious similarity between the elements) in a Direct Analogy, the more useful it is. In clarifying this elusive point, Gordon noted that if we compare "structure" to "cottage," the analogy is too obvious. "Structure" vis à vis "coral reef" better captures the spirit of Direct Analogy. In a like manner, the wheel of a car has more constructive strain with a hoop snake or a spinning seed pod than it does with the cutter on a can opener.

Personal Analogy is a description of how it feels to be a particular animal or object. It involves empathizing with other things, the more completely, the better. Gordon (1969) identified four levels of involvement in Personal Analogy from superficial

recitation of the overtly obvious to strikingly uninhibited success in "becoming" the object in question. The four levels are:

(a) First Person Description of Facts.
Teacher: John, pretend that you are a fiddler crab.

Student: I would be hard on the outside because of my shell, and soft on the inside . . . I would have special little creases on my claws to grip and reach things, and one of my claws is twice as big as the other (p. 21).

Notice that such an attempt really does not show empathy, but is a common description.

(b) First Person Description of Emotions.
Teacher: Joyce, how about pretending that you are a fiddler crab?

Student: I would be pretty busy getting food for myself, but I've got to be careful not to be food for a big fish. I've got to be careful not to get caught, but I must take some chances or the other crabs will beat me to it and I'll starve (p. 21).

This is a slight improvement, but is far short of what can be done.

(c) Empathic Identification with a Living Thing.
Teacher: Peter, imagine that you are a fiddler crab.

Student: O.K. I'm a fiddler crab. I've got armor all around me--my tough shell. You'd think I could take it easy, but I can't. And that big claw of mine! Big deal! It looks like a great weapon, but it's a nuisance. I wave it around to scare everybody, but I can hardly carry it. Why can't I be big and fast and normal like other crabs? No kidding! That claw doesn't even scare anyone! (p. 22).

This description shows novelty, yet within the confines of the task. While it is creative, Gordon demonstrated an even better level of Personal Analogy.

(d) Empathic Identification with a Non-Living Object.

Teacher: Harriet, imagine that you are the mud in which the fiddler crab makes his home.

Student: I have the feeling that no one cares if I'm here or not. I'm full of holes into which the crabs crawl at night. They never thank me. After all, if it were not for me, those crabs would get eaten up in one night.

Teacher: How might you make the crabs thank you?

Student: I wonder if I could seal myself up behind the crabs when they crawl in me. That would give them protection. The darn thing is that I try to move, but I can't. When I see a crab about to be eaten by a striped bass, I want to flow out and wrap around the crab and save him . . . but I can't (p. 23).

This is the epitomy of a good Personal Analogy. The student "becomes" the mud. She empathizes with an object very different from herself, but still retains an interesting cross-section of reality.

Gordon noted some scientific discoveries that seem to suggest the use of this technique. For example,

> the great Dutch chemist Kekule . . . in attempting so solve the riddle of the molecular construction of benzene . . . imagined himself to be a snake swallowing his tail. This Personal Analogy led to the concept of the molecules being set in a circular pattern (p. 23).

Also, Dr. T. A. Rich, a scientist with over 100 patents involving electricity and electronics,

> puts himself in the middle of a problem, trying as he says to 'think' like an electron whose course is being plotted or imagines himself (to be) a light beam whose reflection is being measured (p. 23).

Compressed Conflict, the third synectics technique for Making the Familiar Strange, "is a poetic, two-word description on a

high level of generality where the two words don't seem to fit and sometimes actually contradict each other," (Gordon, 1969, p. 24). Examples might include "imprisoned freedom," "velvet strength," and "nourishing flame." From the fiddler crab descriptions such passages as "tough, but vulnerable," "a weapon that is a nuisance," and "power and courage that doesn't scare anyone," could easily be changed to Compressed Conflict terms. Gordon suggests "hardened vulnerability," "dependent aggression," and " laughable weapon," respectively. Compressed Conflict has similarities to the other synectics techniques, of course, since they all are metaphorically based. However, the surprise factor is at its highest intensity with this technique. On the one hand Compressed Conflict provides the most insight into a problem; on the other, it is the most difficult to use. Examples of Compressed Conflict in science include Cajal, the Nobel prize winning developer of the neuron theory, who referred to a "protoplasmic kiss," and vaccine developer Koch, who began a series of experiments with a "safe attack" (Gordon, 1969, p. 26).

The three techniques of Direct Analogy, Personal Analogy, and Compressed Conflict are the result of over 25 years of work with analogy related problem solving. A chronology of Gordon's activities during this period reads as follows:

1943-1944. Observation of individuals and groups solving problems to identify constants in the creative process.

1944-1949. An early theory of oscillating Psychological States in the creative process. The following constructs were suggested: (a) Involvement-detachment, (b) Deferment,

(c) Speculation, (d) Autonomy of object (the problem and solution appear to have "life of their own,") and (e) Hedonic Response (a good feeling about a hypothesis or solution); "Warm confidence."

1949-1958. The Psychological States were refined into a more operational form. The key phrase summarizing this effort is "Making the Familiar Strange."

By 1961 four operational mechanisms for Making the Familiar Strange were identified: Personal Analogy, Direct Analogy, Symbolic Analogy, and Fantasy Analogy. Direct Analogy was basically the same then and in 1969. Personal Analogy presently discriminates between role-playing and empathic identification. It did not in the 1961 form. Symbolic Analogy evolved into Compressed Conflict and is more operational in its present form according to Gordon (1969). It was previously described as being "produced with the condensed suddenness of a poetic phrase . . ." (Gordon, 1969, p. 277). Fantasy Analogy was deemed unnecessary by 1965 (Gordon, 1969) since fantasy appeared to be a natural part of the other techniques. Overall, the synectics techniques have played an important part in the growing acceptance of operationalized idea producing methods, especially in industry.

Bionics.--Bionics is a design engineering concept with many similarities to synectics techniques since it involves investigating the

> structure, function, and mechanisms of plants and animals to gain design information for analogous man-made systems (Bionics, 1963).
>
> It is a way to
>
> study basic principles in nature and emerge with applications of principles and processes to the needs of mankind (Papanek, 1969, p. 6).

The number of inventions and improvements that can be traced to the study of analogous structures, functions and mechanisms in nature is very large. The eye of the frog helped develop an electronic property filter which suppresses certain phenomena while allowing others to pass. Beetles' eyes have suggested improvements for advancing film in aircraft cameras. Moths' and bats' ears have aided in developing radar anti-jamming devices. The European warbler (which navigates by sun during the day and by the stars at night) has been studied to help improve navigational procedures. The low friction properties of whales and porpoises have suggested improved propulsion systems for submarines. In earlier days, birds were closely studied by aspiring aviators, and other natural phenomena suggested man-made levers and wheels. Papanek notes a difference between early designs and inventions and those exemplifying modern bionics.

> Whereas we may consider the first hammer an extension of the fist and the first rake a type of claw, bionics today is less concerned with the <u>form of parts</u> or the <u>shape of things</u> than it is with examining <u>how</u> nature makes things happen, the <u>inter-relation</u> of parts, the existence of systems . . . If the Industrial Revolution gave us a <u>mechanical era</u> (a static technology of movable parts), if the last sixty years have given us a <u>technological era</u> (a dynamic technology of functioning parts), then we are now emerging into a <u>biomorphic era</u> (an evolving technology permissive of imitation). Author's italics, Papanek, 1969, p. 6.

Who knows, maybe the device to transport rockets from the Cape Kennedy Vertical Assembly Building to the launch pads was inspired by observing an army of newly-hatched sea turtles marching from the sand to the surf.

Morphological Synthesis/Analysis.--Next we turn to a technique which is at the other end of the playfulness-organization spectrum. Morphological synthesis/analysis[1] is a logical extension of Crawford's (1954) attribute listing, but has different historical beginnings. Zwicky (1957) first referred to the concept by name although Allen (1962, 1966) is given credit for refining it. Davis (1971) defines morphological synthesis as follows:

> One first identifies two or more dimensions (or attributes) of the problem . . . Second, one lists ideas for each of these dimensions . . . Finally [he] evaluates the huge number of all possible idea combinations (author's italics).

From the tremendous number of ideas produced by such combination, most will be useless. However, a few may be quite promising, themselves, or may inspire a related idea.

Arnold (1962) said,

> The morphological analysis is the most comprehensive way that I know of to list and examine all the possible combinations that might be useful in solving some given problem (p. 257).

He compared attribute listing and morphological analysis in terms of the kind of problems best handled by each. Attribute listing works best with very specific problems while use of morphological

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[1]Both terms, "morphological analysis" and "morphological synthesis" have been used to label this concept. Some writers (e.g., Osborn, 1963) use the former, while one of the inventors of this method (Allen, 1962, 1966) prefers the latter. The present writer will use "synthesis" since it more aptly emphasizes the "joining together" nature of the process.

analysis should deal with generic and basic matters. Arnold noted that the morphological analysis technique involves stating the problem as broadly and generally as possible and also defining the dimensions broadly. He used an analogy of drawers to illustrate the advantage of combining the various dimensions. In a three dimensional morphological analysis, for instance, each cell corresponds to a drawer. Upon opening some drawers, one finds that they are filled with things that are already invented; many drawers will be empty since the combinations are absurd or impractical. Some, however, will be filled with ideas that are surprisingly appropriate and yet novel.

Categorizing such a straight-forward, forced combinations method as being creative is bound to attract criticism from those who feel "true" creativity must be a spontaneous unexplainable gift. Papanek's (1969) words regarding some contemporary architects might speak for those skeptical of morphological synthesis' creative nature although he is not attacking the technique per se. He says,

> With more and more emphasis on buildings being placed on dollar-per-cubic-foot cost, the role of the architect has been neatly reduced to one of a jigsaw puzzle assembler. With 26 volumes of 'Sweet's Catalog' at his elbow, the contemporary architectual designer fits together a puzzle called 'house' or 'school'; he plugs in components (designed, for the most part, by industrial designers and conveniently listed among the 10,000 entries in 'Sweets'), substituting aluminum sandwich panels filled with polystyrene for the marble fascial used by his predecessors (p. 5).

However, the usefulness of morphological synthesis and attribute listing is recognized. Davis (1971) states that

> at the very least, we must agree that (a) such procedures can lead to new, potentially valuable ideas and problem solutions, and (b) even the most intuitive of creative persons may find himself modifying attributes and forcing combinations . . .

Free Association Technique.--This technique was developed in the tradition of stimulus-response oriented experimental psychology. Its behavioristic origins have been articulated by Maltzman, Bogartz, and Berger (1958). They say,

> In terms of S-R theory the response that occurs to a given stimulus in the free association situation is the one which is dominant in the response hierarchy elicitable by that stimulus. It has the greatest amount of excitatory strength at the moment of stimulus presentation. Responses that are uncommon or original must be lower in the response hierarchy, possess a weaker excitatory potential. If, therefore, a situation could be arranged in which S is induced to give responses low in his hierarchy, there would be an increase in the originality of his responses. Training of this nature might then produce a disposition to give uncommon responses in other situations. The procedure employed in this study in an attempt to produce the desired effect is the simple one of repeatedly presenting the same stimulus words with instructions to give a different response each time. This is only one of several different procedures that may be used to induce Ss to increase the uncommonness of their responses, but it is well suited for use in the free association situation (p. 392).

Maltzman's basic originality training procedure involved giving Ss the same training list of words several times and requiring them to give different verbal associates each time the list was presented. This ostensibly forced Ss to respond more originally as the number of presentations increased since low-dominance responses would be emitted. Maltzman (Maltzman, Bogartz, & Berger, 1958; Maltzman, 1960) found that this tendency seemed to transfer to test lists. However, several other studies have noted something less than clear-cut results when procedures were changed slightly. After reviewing research relating

to free association training, Davis, Manske and Train (1967) concluded that

> a seemingly reasonable general conclusion would be that practice in free associating, via the repeated training list procedure outlined by Maltzman, may very well result in a tendency to give more original verbal responses in open-ended transfer tasks such as the test list and Unusual Uses test. If specific verbal responses are needed, as in the Remote Associates Test, the originality training does not seem to reliably help unless the verbal training stimuli or responses are ostensibly associates of the needed solution words (pp. 10-11).

More specifically, Maltzman, Bogartz, and Berger's results showed that instructions to be original plus originality training increased test list word originality, but decreased originality on the Unusual Uses test. Maltzman, Simon, Raskin, and Licht (1960) found different results. Ss who gave one verbal associate to each of 125 words, performed as well on the test list as did the training group who received five presentations of the same 25-word list. The training group did give more original responses on the Unusual Uses test, however. Penny and McCann (1962) found the same to be true using retarded children as Ss. Rosenbaum, Arenson, and Panman (1964) changed the temporal placement of instructions to "be as original as possible" from just before the test list as Unusual Uses test to just before the training list, otherwise replicating Maltzman, Bogartz, & Berger's (1958) procedure. Results for test list performance showed independent positive effects on the test list for the training method and for instructions. Unusual Uses performance also increased as a function of originality training, but not as a function of instructions.

Gallup (1963) had several basically negative comments regarding Maltzman's method as a result of some experiments he conducted. Gallup found (a) even one presentation of a training list can increase originality performance on a test list; (b) verbal responses on a test list might be due to instructional set more so than originality training per se; (c) experience in associating, even via such tasks as arithmetic problems and vocabulary tests, was the crucial factor in transferring originality to test measures, and (d) a replication of Maltzman's study showed no differences between experimental and control groups. Maltzman and Gallup (1964) presented a joint comment in which they stated that such methodological factors as sample size and sex differences were possible explanations for their respective findings. Using a convergent dependent measure, such as performance on Maier's two-string problem, the findings are more conclusive: Free association training does not facilitate performance. Such results have been found by Caron, Unger, and Parloff (1963) as well as by the Maltzman group itself (Maltzman, Belloni, & Fishbein, 1964).

Checklist.--Another idea-finding technique is called the checklist method. Davis (1971) writes, "The checklist strategy simply amounts to examining some kind of 'list' which could suggest solutions suitable for a given problem," (p. 9-1). "List" is broadly conceived and can include such diverse sources of ideas as: deliberately constructed hints; the Yellow Pages; want ads; dictionaries; Thesauruses; department or hardware store catalogs and shelves; and, most inclusive of all, "the things around us." Like other

techniques, checklisting forces the user to draw from sources that are very available, but not obviously relevant to a given problem.

Checklists may be used to stimulate new idea combinations, to suggest problem approaches, and to evaluate ideas. Several idea-stimulating checklists have been specially constructed, for example, Osborn's (1963) "73 idea-spurring questions," "Mr. I's Checklist," (Davis & Houtman, 1968), and several checklists of various length designed for experimental purposes by the Davis group (see, e.g., Davis, Roweton, Train, Warren, & Houtman, 1969). Polya (1957) constructed a checklist which teaches different forms of questioning for dealing with difficult and unfamiliar mathematics problems. Mason (1960) devised a checklist for idea evaluation which included such questions as, "Is the idea simple?" "Is it compatible with human nature?" "Does the idea 'explode' in people's minds?" and "Is it timely?" Arnold (1962) noted that King Camp Gillette, inventor of the safety razor, would systematically go through the alphabet, letter by letter, listing the name of every product or human need he could think of beginning with a given letter. The alphabet, too, can be an idea checklist in a broad sense of the concept.

In one study of the checklist procedure, Torrance (1961) used a 2 x 3 x 2 design in which the factors were training with checklist principles (trained or untrained), grade level (first, second, and third grade Ss), and instructions (either directing them to produce many ideas, or to produce clever or unusual ideas). Fluency,

Flexibility and Originality measures were analyzed regarding Ss' suggestions for improving a stuffed toy "so it would be more fun to play with." The results showed that trained second and third grade Ss scored consistently higher than control Ss on all three measures. First grade Ss did not. Also, Ss motivated to produce clever ideas actually produced more ideas than Ss motivated to generate many ideas. Torrance interprets this as an indication of lessened inhibition for the "clever" group. Cartledge and Krauser (1963) did a follow-up on the Torrance study using only low-creativity first grade Ss. After five 20-minute checklist sessions, experimental Ss significantly outperformed control Ss. The Torrance quality-quantity finding was not replicated.

In a series of experiments at the Wisconsin Research and Development Center for Cognitive Learning, Davis and his co-workers investigated idea checklists. Three studies by Train (1967) showed no differences between the creative performance of college Ss who received checklist training and control Ss who did not. In Experiment I, Train's Experimental Group used a list made up of 55 of Osborn's "73 idea-spurring questions" while thinking of ways to change or improve either a car, an office desk, or a kitchen sink. All Ss worked ten minutes on each of the three problems. Control Ss produced slightly more ideas than did Checklist Ss and, furthermore, Control Group ideas were rated as slightly more original. Train suggested that the results might be due to the high degree of complexity of the problem objects and consequently compared Checklist vs. Control Ss' performance on a simple (a cup) and a

more complex (kitchen sink) task in a second experiment, this time allowing 20 minutes per problem instead of ten. Results were similar to the first study. The availability of the checklist did not stimulate idea production in the different treatment combinations. The quality and quantity of ideas produced by the Control Ss was almost identical to that of the Checklist group. In Experiment III Train tried a more detailed list. Osborn's items were expanded. For example the suggestion "Change form" became "New Form (square, triangle, oval, rectangle, sharp corners, round corners, asymmetrical, doughnut shape and other forms?)." Again Ss were allowed 20 minutes and again the availability of the checklist did not influence idea quality or quantity relative to the performance of a control group. A fourth experiment in the series, conducted by Davis and Roweton in 1968 (see Davis, Roweton, Train, Warren, & Houtman, 1969), investigated the effects of another long checklist. This one, taken from a creativity training program (Davis & Houtman, 1968) for upper-elementary and junior high school students, was quite detailed (see Appendix A). But, as in Train's first experiment, the Control Group produced an insignificantly larger number of ideas than did the Experimental Ss.

A fifth experiment (Davis & Roweton, 1968) revealed a checklist that significantly did facilitate idea production. They provided one group of college students with the following brief checklist, entitled "Aids in Thinking of Physical Changes," containing only seven general categories of problem solutions:

Add and/or subtract something.

Change color.

Change the material.

Change by rearranging the parts.

Change shape.

Change size.

Change design or style.

Checklist Ss also received a brief explanation of the meaning of the checklist's items and how these items could be applied to changing virtually any object. Checklist and Control Ss were instructed to "List as many physical changes as you can for a thumbtack/kitchen sink." The dependent measures were: (a) total number of ideas listed, (b) mean ratings on a seven-point "creativity" scale by two judges, (c) number of ideas rated above the midpoint on the creativity scale, and (d) percent of ideas rated above the midpoint of the scale. Results showed, first, Checklist Ss produced roughly two and one half times as many ideas as did Controls. Second, Checklist Ss' ideas were judged more "creative" than Control Ss' ideas. Third, Checklist Ss produced about five times as many ideas rated above the midpoint of the scale as did the Controls. Davis and Roweton concluded that an effective checklist must stimulate or challenge an individual to generate his own ideas. "A lengthy idea checklist that gives problem solutions to the S if only he will transfer the ideas to his scoresheet, simply does not initiate a highly motivated flow of associative behavior" (p. 225).

In a study relating two checklists (the brief, seven-item list and a long list; see Appendix A) and verbal pretraining to Ss' field dependence-independence and grade point average, Roweton (1969) found no superiority in the short checklist successfully used by Davis and Roweton earlier. In fact, Long Checklist Ss were more flexible and produced more highly practical physical changes than did Controls or Short Checklist Ss.

Davis et al. (1969) note that precaution and qualifications must be heeded in working with the checklist method. The nature of the problem, the type of S, and the type of checklist are all relevant variables. An accurate assessment of its applicability will likely involve designs which allow for interactions between and among these factors.

Research Comparing the Various Techniques

In spite of the increased interest in creativity and the several attempts to operationalize it and teach it, virtually no research has involved comparing various techniques. We know very little about Technique A vis-à-vis Technique B used by particular Ss in a given setting. One exception is a recent experiment by the present writer and Davis (Warren & Davis, 1969). Using college Ss, they compared two checklist treatments with morphological synthesis (MS) and control treatments. One checklist was the Short Checklist (SCL) found to significantly facilitate idea production by Davis et al. (1969). The other was Osborn's (1963) "73 idea-spurring questions" (LCL). Written instructions regarding

the three techniques (SCL, LCL, MS) were randomly distributed to Ss who read them before trying to "think of ways to change or improve a door knob." Control S "instructions" contained only the problem statement. No time limits were imposed in this study. Eight dependent measures were generated: (1) time spent working, (2) total number of ideas produced, (3) number of ideas per minute, (4) mean idea "originality" (i.e., uniqueness) as rated by two judges, (5) mean "practicality" (i.e., potential usefulness, feasibility) as rated by two judges, (6) number and percent of ideas rated in the upper half of the "practicality" scale by both judges, (7) number and percent of ideas rated in the upper half of the "originality" scale by both judges, and (8) number and percent of ideas rated above the scale midpoint on both "originality" and "practicality" by both judges.

Especially interesting were the following findings: Regarding problem solving time, the SCL group tended to work longer than the MS group who, in turn spent more time than either LCL or Control Ss. While this supports the earlier Davis et al. interpretation that the SCL is intrinsically motivating, the overall F did not reach statistical significance. The frequency measure did show a significant difference between groups, however. MS Ss produced more ideas than either LCL Ss or Control Ss. While SCL Ss produced approximately double the number of ideas generated by LCL or Control Ss, these differences did not reach significance. MS Ss also produced ideas faster (as measured by "ideas per minute") than

Controls, LCL, and SCL Ss. SCL Ss produced ideas faster than either LCL or Control Ss but these differences again did not quite reach statistical significance. The groups did not differ markedly in mean rated "originality" or "practicality." However, the measures of (1) mean number of ideas above scale midpoint in "originality," (2) mean number of ideas above the scale midpoint in "practicality," and (3) mean number of ideas above the scale midpoints in both "originality" and "practicality," all reflected about the same performance as did the total idea frequency measure. That is, MS Ss produced the most ideas in all three categories, SCL Ss produced fewer, while LCL and Control Ss produced the fewest ideas in all three categories. Finally, the percentages of ideas in the three categories were relatively constant across the four groups.

Two conclusions seemed appropriate to Warren and Davis regarding creativity techniques. First, the high productivity of MS Ss supports earlier claims (e.g., Allen, 1962; Arnold, 1962). MS Ss generated the most ideas in less than the greatest amount of time. Second, the SCL technique was again shown to be a better method of eliciting product change or improvement with college Ss than a longer, more detailed list. The Short List does appear to be more motivating to college students.

Programming Creativity

Crutchfield and Covington (1965) noted that the strongest features of programmed instruction appear to be rather opposed to the nature (and nurture) of creativity. For example, (1) the

uniform understanding of material which is realized at the end of a successful programmed instruction experience seems contrary to the diversity needed for creative production. (2) The highly structured and controlled nature of programmed instruction may be antithetical to the "natural" divergence and uniqueness of a creative act. (3) The smooth, effortless nature of programmed instruction may conflict with the searching and striving which characterizes much creative production. (4) Programs offer little chance for dissent, rejection, or questioning, activities which partly define a creative person's behavior. (5) The ultra-clarity, precision and definiteness of programmed instruction seems counter to the tolerance of and revelling in complexity, ambiguity and lack of closure which is a feature of creative individuals.

Crutchfield and Covington then pointed out how these potential difficulties can be mitigated by careful adherence to certain rules necessary for constructing programs that teach creativity. Among them are the following suggestions: (1) Programmed materials should allow for repeated practice in making creative responses. Series of actual problems can be provided. (2) The size of a program step should be large enough to induce an "essential tension" and challenge in the reader. In line with this suggestion, a creativity program "is likely to contain more complex materials, require more time for reflection, and call for multiform rather than single responses." (3) Feedback involves a particularly difficult, but not impossible, problem for writers of creativity programs.

The "one correct answer" concept does not exist since many radically different responses could be appropriate. [In order] To provide feedback that is relevant to all people taking the program, an "illustrative set of varied and unusual ideas" must be provided. These illustrative responses must be carefully chosen to show novelty as well as appropriateness to the task [at hand]. They must be neither overly simple and automatic nor of such "consistently superior quality as to discourage the student from thinking of his own ideas because he feels hopelessly inadequate when compared with the standards set by the feedback." Crutchfield and Covington also suggest providing extensive and complete feedback early in the program, but reducing it in the latter stages when the reader is more experienced.

Shackel and Lawrence (1969) wrote "an autoinstructional programme designed to develop creative skills," and tried to follow Crutchfield and Covington's ground rules. They compared the program with three other instructional methods: a conventional lesson, with exercises, covering the same material as the program; a series of exercises, drawn from the practice items of the program; and a control group which received no treatment. The 80 Ss, homogeneously high in ability, were chosen from the sixth grades of Christchurch, New Zealand, area schools. The four treatment levels were randomly assigned to four classes. Boys and girls were almost equal in number in the four classes, but a smaller number (10 boys, 10 girls) were randomly selected from each class for purposes of analysis.

Pre-tests for each group were selected from Torrance Tests of Creative Thinking (Torrance, 1966), French's Kit of Reference Tests (1963), and an essay test. Post-tests included another essay test, Torrance Tests, and French's Kit selections. Gain scores showed the autoinstructional method to be significantly superior to all other methods for 21 of 23 measures. With somewhat less consistency, the "lesson" and "exercise" groups were superior to Controls.

Shackel and Lawrence conclude that

> on the evidence contained in this study, programmed instruction can not only be presented in a way which eliminates its potentially detrimental effects upon creative thinking, but can be directly utilized as a powerful instrument for the exercise and training of such abilities (p. 54).

The Present Study

The Warren and Davis (1969) study is obviously a mere beginning at comparing the effectiveness of idea-stimulating techniques in controlled settings. Ideally, large scale research would investigate perhaps several academic courses, each one focusing on a particular technique and taught by personnel skilled in, and prepared with materials for, that particular strategy. Knowledge gained would contribute to the construction of new and better creative thinking courses in the tradition of Parnes, Torrance, Covington and Crutchfield, and Davis and Houtman. A worthwhile future goal is the incorporation of such courses as an integral part of school curricula.

The present study has a more modest purpose. It will compare several techniques selected from those mentioned above on the basis of two criteria: The techniques to be studied must (a) provide a cross-section of several points on the playfulness-organization dimension, and (b) be applicable to an individually guided treatment presentation. Reasons for the first constraint are obvious. The second deserves some elaboration. An individually guided procedure allows an experimenter to work with single Ss as the experimental unit. Each treatment level can be randomly assigned to members within a group (e.g., a school class), reducing the number of Ss and the amount of time required. Also, the less-desirable group guided procedure would involve teaching various creative thinking techniques to teachers/experimenters and probably interfere with the everyday routine of the schools involved. On the other hand, individually guided treatments require no intermediary such as a teacher, and can better fit into the typical school day by using "free time" and study hall periods. The most feasible vehicle for presenting the various creative thinking techniques would appear to be some kine of "program."

So, some carefully thought out principles of combining programmed instruction with creativity-type subject matter exist. Evidence from one study suggests that a programmed approach is quite competitive with other methods. Four programs were written for the present study, each one exemplifying a particular creative thinking technique and using the Crutchfield-Covington suggestions as guidelines.

The techniques chosen were: Checklist, Free Association Technique, Part-changing (Morphological Synthesis), and Personal Analogy.[2] Subjects were sixth grade students in a middle-sized Wisconsin city.

Hypotheses.--Some hypotheses were specified for the dependent measures based on research reviewed above. Table 1 shows the predicted outcomes.

In general, it was predicted that the more "playful" techniques would elicit better performance on measures of Flexibility, Originality and "Best Ideas," all derived from two Torrance Test of Creative Thinking (1966) subtests, Product Improvement and Unusual Uses. On the other hand, hypotheses regarding Fluency, derived from the same subtests, predicted higher scores for techniques that emphasize organization. The writer considers Personal Analogy as the most "playful" of the techniques used in this study, Parts as the most "organized" with Checklist, Free Association, and the control levels somewhere inbetween. No hypotheses were made for the Warren and Davis Distant Linking Exam (the WADDLE; Warren & Davis, 1970) a newly developed, convergent, children's association test modeled after Mednick's Remote Associates Test (RAT; Mednick, 1967).

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[2]Gordon (1969, p. 20) notes that the technique of Personal Analogy is the most desirable with which to introduce children to metaphorical thinking.

Table 1

A Summary of Hypotheses[1]

Dependent Measure	Hypothesis
Flexibility (TTCT, Prod. Impr. & Unus. Uses)	PA > CL, FAT, CWB, CWOB > Parts
Fluency (TTCT, Prod. Impr. & Unus. Uses)	Parts, CWB, CWOB > CL, FAT > PA
Originality (TTCT)	FAT, PA > CL, CWB, CWOB > Parts
"Best Ideas"	CL, FAT, PA > CWB, CWOB > Parts
"Warren And Davis Distant Linking Exam"	No hypothesis is being made.

[1] CL = Checklist
CWB = Control with Booklet
CWOB = Control without Booklet
FAT = Free Association Technique
Parts = Part-changing
PA = Personal analogy

Chapter III

METHOD

Subjects.--The Ss were 119 (60 boys, 59 girls) sixth grade students from eight classes in three Madison, Wisconsin public elementary schools. All classes participated with the permission of the home room teacher. In school Number 1, one class of 24 (13 boys, 11 girls) students participated; in school Number 2, five classes of 69 (33 boys, 36 girls) participated; and in school Number 3, two classes of 26 (14 boys, 12 girls) participated (See Table 2).

Originally there were three more boys in school Number 2, but they were asked to leave for disturbing their respective experimental session (See page 46 below for further explanation).

Available academic records of students included either Lorge-Thorndike IQ scores, Stanford Achievement Test language scores, or both. Both IQ and language scores were available for 115 Ss (58 boys, 57 girls) while 2 Ss (1 boy, 1 girl) had missing IQ scores and 2 Ss (1 boy, 1 girl) had missing language scores.

Design and Procedure.--A 6 x 2 x 3 factorial design with six Treatments, two levels of Sex, and three Schools was used. Each S

Table 2

Experimental Design and
Subject Assignment

Schools	Sex	Treatment						Totals	
		Checklist	Free Association	Parts	Personal Analogy	Control w. Booklet	Control w.o. Booklet	Rows	Schools
School 1	Females	2	2	2	2	1	2	11	24
	Males	2	2	2	2	2	3	13	
School 2	Females	6	6	6	6	6	6	36	69
	Males	6	6	5	6	4	6	33	
School 3	Females	2	3	2	2	1	2	12	26
	Males	2	2	2	3	3	3	14	
	Totals	20	21	19	21	17	21		119

within a given Sex x School cell was randomly assigned to one of the six treatment levels. Four of the treatment levels were Experimental groups and two were Control groups. Since the treatment task for all Experimental groups and one Control group involved reading and performing exercises in a programmed booklet, there were five booklets. Each Experimental booklet described one creative thinking technique through use of text, illustrations, and constructed response exercises The Control booklet required Ss to complete unfinished stories. It also had text and illustrations. The second Control group did not read a booklet. The five groups which read booklets will be referred to as "Booklet" Ss.

Treatments and dependent measures were administered in groups, usually with 15 Ss per group and usually with equal representation of each of the five groups using booklets. Each Sex x Treatment cell was always represented by at least one S in every experimental session. The treatments and the dependent measures were administered in a single experimental session. The order and time required for each activity for the Booklet Ss was as follows: (a) Read training booklet--approximately one hour; (b) Rest break--five to 10 minutes; (c) Torrance Tests of Creative Thinking (TTCT), Product Improvement exercise--10 minutes; (d) TTCT, Unusual Uses exercise--10 minutes; (e) Rest break--approximately two minutes; (f) Warren and Davis Distant Linking Exam (WADDLE, 1970)--20 to 25 minutes; (g) Rest-stretch break-

-approximately 30 seconds; (h) Attitude questionnaire--approximately three minutes. The total time required, therefore, was about two and one half hours. Control Ss without booklets did not do (a), (b), (g), and (h). Fudgesicles were given to every S, usually after the entire session was completed, but in three instances at School 2, during the break after the treatments.

Materials.--The main purpose of this experiment was to compare various creative thinking techniques. Again, for each of four techniques, a booklet was written which discussed the principles and provided exercises pertaining to that technique (Appendix B). A booklet was also constructed for one Control Group, while a second Control Group did not read a booklet. The five Booklet groups may be designated as Checklist (CL), Free Association Technique (FAT), Part-changing (Part), Personal Analogy (PA), and Control with Booklet (CWB). The second Control group was Control without Booklet (CWOB).

The four experimental booklets were each written with Crutchfield and Covington's basic rules for creativity programming in mind. That is, (1) Repeated practice in making responses was provided; (2) "Steps"

in the program were larger than the usual progression, and were constructed to induce an "essential tension;" and (3) Feedback always included several possible responses, given by characters in the booklets who were the same age as the Ss. These "answers" were of varying quality, never overweighted with superiority. Feedback was more extensive and complete early in each program with decreasing amounts toward the midpoint and end.

Before the booklets were constructed, "problems" were solicited from students in several sixth grade classrooms. Many of these suggestions were used in writing the booklets in order to maintain a student's perspective. Several other variables were deliberately controlled. They are summarized in Table 3. More specifically, a fifth grade reading level, as measured by Dale & Chall (1948a, 1948b) criteria was a goal. Early versions of the booklets were typically more difficult reading than desired. By shortening sentences and using "easier" words, reading levels close to the fifth grade level were obtained. An early draft of each booklet was read by several sixth grade students (boys and girls, representing a range of IQ and reading scores) who in turn commented about difficult and/or confusing passages. Also, each of the writer's departmental committee members read and commented upon each booklet. The final versions incorporated suggestions from both sources.

Table 3

Summary of Booklet Variables

Variable	Checklist	Free Association	Parts	Personal Analogy	Control Booklet
Readability Grade Equivalent (Dale & Chall, 1948a, 1948b)	5.16	4.88	4.78	4.91	5.09
Number of Words	1739	1699	1556	2068	896
Number of Opportunities for Responding	7	6	8	7	5
Number of Illustrations	8	5	6	6	5
Number of Pages	34	28	30	32	25

Another variable, the number of opportunities for constructed responses probably is not a very descriptive measure since the kind of response varies considerably among the booklets. For example, the five CWB responses each involve completing an unfinished story (i.e., writing sentences and paragraphs). On the other hand, responses for the Parts booklet often are short, two or three word answers. For this reason, in Table 3 the writer has tabulated the major opportunities for responding. This means a distinct group of short answer opportunities is counted as only one response. A response requiring rather lengthy elaboration is also counted as one major response opportunity.

Note that the CWB booklet is quite comparable regarding each variable except length. The control booklet consisted of incomplete stories taken from Jean Ullyette's Guidelines for Creative Writing (1968; Appendix B). No attempt was made to program this booklet. It was merely a "non-creative technique" vehicle which was included [in order] to control for factors other than the content taught by Experimental booklets.

Each Experimental booklet also had a form of overview or advance organizer comment on the first page which stated, "This book is about ideas. When you finish reading it, you will know how to think of more good ideas. Here is why you will be able to think of more good ideas: (At this point the short statements below, each specific to the booklet in question, were included)

Checklist: You will know that borrowing from older ideas can help you think of new ideas. People always borrow some ideas when they think of new ones. Ideas can be borrowed from many places.

Free Association Technique: You will know that the last ideas you think of will often be the best ones. The first ideas must get out of the way. Then the best ideas can appear.

Part-changing: You will know that everything has parts, and parts can be changed. Changing parts is a good way to think of new things and ideas.

Personal Analogy: You will know that pretending helps you. So does comparing things, especially things that are not usually found together.

Each overview page concluded with the comment, "You should have fun reading the book and thinking of ideas."

Each Experimental booklet also had a final page entitled "A look back..." For each technique this page was a summary, overlapping some with the overview statement, but going into more detail by generally referring to the body of the respective booklet. The summary pages for the four Experimental booklets were as follows:

Checklist: Borrowing from older ideas can help you think of new ideas. Inventors always borrow at least some ideas when they think of new things.

Borrowing is not the same as copying, because when you borrow, you change something.

Ideas can be borrowed from many places. One of the best ways to borrow is by looking at the things around you.

Free Association Technique. You should not stop trying when you have thought of only a few ideas. The last ideas you think of will probably be your best ones.

The ideas you first think of often won't be your best ones. The first ideas must get out of the way. Then the best ideas can appear.

Part-changing: Almost everything has parts, and parts can be changed. Changing parts is a good way to improve things. Changing parts also helps you invent new things.

A checkerboard helps you join new part ideas together.

Some of the ideas from the checkerboard will be good ones.

Personal Analogy: You can think of new and better ideas by looking at things in new and different ways. Pretending a lot is a big help. So is comparing things that are not usually found together.

New and different comparisons make the world seem more alive and interesting.

If you choose your own comparisons, you are using what you already know to think of new ideas.

To a degree each Experimental booklet had a style of its own. Originally, an attempt was made to develop each one using identical substantive examples, dialogue, settings, etc., with the only difference among booklets being the dissimilar basic principles of the particular techniques. This proved futile, however,[3] and so the writer used a substantive context which seemed "natural" to a particular technique. A summary of the "plots" follows (See Appendix B for each complete program).

Checklist: "Original" ideas which are really not all-that-new are discussed. For example, Shakespeare, the Wright brothers and Edison all borrowed ideas coming before them. Next the borrowing method is seen in a school context with a distinction made between borrowing and plagiarizing ideas. As an exercise, the Ss are asked to borrow

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[3]A future study, presently in the planning stages, will be administered by trained teachers over a longer time span. An attempt will be made to include materials that are virtually identical in all aspects except those defining the various techniques.

ideas from headlines, the Yellow Pages, want ads, contrived lists of hints, and, most importantly, "the things around him."

Free Association Technique: Best ideas often come last. If one persists, his next idea will probably be better than his present one. Characters in the booklet illustrated this principle in trying to find ways to earn money, and in thinking of new ways to clean teeth. "Hidden ideas" can be brought into view by consciously thinking of many ideas.

Part-changing: Almost everything has parts and by changing the parts of common objects around us, some surprising novelties result. Ideas for new and different bicycles, houses, cities, classrooms, and furniture are shown to be rather easily obtained. A new kitchen is "designed" and wild golf bags are discussed in spurring ideas for a company that sells them. Finally, Ss are taught to combine changes for various attributes with the expectation that new, "unthought-of" ideas will result.

Personal Analogy: Things that we do not think go together, sometimes do. An extended example of how falling maple tree seeds inspired an imaginative way of fighting forest fires is discussed. Readers learn that inventors pretend a lot and this helps them think of fascinating relations between things. The students participate by pretending they are an animal of their own choosing. They are taught that they can best learn about their animal by uninhibitedly empathizing with him.

Testing Sessions.--Differences in the testing sessions among the three schools were unavoidable due to (a) availability of rooms, (b) number of Ss involved, and (c) an attempt to minimize disruption of the

normal school routine. Two experimenters were present at all testing sessions except at School 2 during the CWOB sessions when only one was present.

Some specific comments regarding testing conditions at each school are as follows:

School 1: One testing sessions was held in the Ss' regular classroom. General instructions (see Appendix C) were read to all Ss, experimental and control. Then the CWOB Ss went to the school's Instructional Materials Center (IMC) while Booklet Ss read their booklets and wrote their exercises. The dependent measures were administered by one E to the large group in the classroom, while the other E simultaneously tested the smaller group in the IMC.

School 2: Four groups of 15 Booklet Ss were run in either an art room with tables large enough to seat three Ss, or in a classroom normally seating 25-30 students. Equal numbers of each of the four experimental levels and the CWB level were represented. Two of these sessions included five boys and 10 girls and two sessions included 10 boys and five girls. The sessions were counterbalanced regarding morning and afternoon administration. In each of three School 2 Booklet sessions, one boy was asked to leave due to his disturbing the group. In each case the general mood of the group changed markedly, and the loss of the expelled S's data seemed well worth the improved testing environment that resulted. The expulsions were accomplished with a minimum of disturbance and class reaction. The CWOB Ss from School 2 were administered the dependent measures in two sessions (one

morning, one afternoon) of six Ss each. The sessions began at the same time that tests were administered to the Booklet groups.

School 3: The Ss were tested at tables in a basement "sack lunch" room. Two sessions were held, each one consisting of one class of sixth grade students. In the first session, after the introductory comments, the CWOB Ss returned to their classroom where they studied their school-work. When the remaining five groups were ready to begin working on the dependent measures, one E accompanied the CWOB Ss to an empty teachers' room and administered the appropriate dependent measures. In the second session, on the other hand, CWOB Ss were brought back to the lunch room to work on the dependent measures with the rest of the group. This change was made due to the smaller total number of Ss being run, which allowed more room.

Dependent Measures.--The following tests and measures were used: (1) Product Improvement, Torrance Tests of Creative Thinking (Torrance, 1966, Activity 4, Form B), scored for Fluency, Flexibility, and Originality. (2) Unusual Uses, TTCT (Activity 5, Form B), scored for Fluency, Flexibility, and Originality. (3) The five "best" ideas elicited by the Product Improvement and Unusual Uses tests, respectively. (4) The Warren and Davis Distant Linking Exam (1970, WADDLE), a convergent association test (see Appendix D). (5) An attitude questionnaire regarding Ss' impressions of the five booklets (see Appendix E).

More specifically, the Product Improvement exercise involved improving an object (a toy monkey) by listing clever, interesting, and

unusual changes for it, yet maintaining its original character as a toy. This task is relatively constrained in that a specific problem object is utilized and Ss' efforts are limited to that object. Fluency is the number of relevant, non-duplicated ideas written by a S. Flexibility is the number of different categories, approaches, or principles a S uses in responding. For example, if S suggests "red monkey," "blue m.," "orange m.," and "green m.," he would get a Fluency score of 4, but a Flexibility score of only 1 since all of his responses are from one category, namely color. If, on the other hand, he suggested "blue monkey," "rubber m.," and "glowing eyes on m.," he would still get a Fluency score of 4, but a Flexibility score of 4 also, since his responses are from different categories. Originality scores are determined on the basis of uniqueness of responses. Dozens of sample responses are provided in the scoring manuals and scorers are instructed how to evaluate unlisted responses showing "creative strength." All responses were scored "blind." That is, neither S's name, treatment group, school, nor sex were known by the writer, who did all of the scoring.

The Unusual Uses task requires S to think of different or unusual uses for a rather common object (tin can). A "solution" in this task is less constrained than in the Product Improvement task in the sense that no one product or end result is a goal. Again Fluency, Flexibility, and Originality scores are computed.

A contrived measure, "Best Ideas," was devised before the experiment was run and implemented by selecting S's five most original ideas

for each of the two problems, with the requirement that the five ideas be from five different Flexibility categories. This measure is addressing itself to the fact that a given technique might elicit one (or two, three, four, five...) idea of high quality which is not clearly reflected in total Fluency, Flexibility or Originality scores. By comparing techniques with regard first to their one best idea, then comparing their two best ideas, then their three best, etc., some insight regarding this matter might be gained.

The WADDLE is a recently developed test of children's associative ability and is modeled after Mednick's (1967) Remote Associates Test (RAT). The RAT has been a frequently used measure of adult creativity. The authors thought a children's version would be a useful research tool. In the WADDLE (or RAT), Ss are given three stimulus words and are asked to think of a fourth word which is somehow related to all three. An example of a WADDLE-type item is as follows: Given the words salt, Indian, and ship, Ss should think of OCEAN. All WADDLE stimulus and response words were taken from Palermo and Jenkins' (1964) Word Association Norms. However, Palermo and Jenkins stimulus words became WADDLE response words, while Palermo and Jenkins response words were WADDLE stimulus words. Palermo and Jenkins presented 200 stimulus words to Ss of various ages and tabulated the frequency with which each stimulus word elicited particular response words in a free-association paradigm. For example, the Palermo-Jenkins stimulus word SOLDIER elicited, with a relatively low frequency, tin, officer, and guard. For the WADDLE the three words tin, officer, and

guard are given, and Ss must think of SOLDIER, a word "distantly linked" to all three given words. WADDLE items were drawn only from Palermo-Jenkins sixth grade norms, using only words which sixth graders gave as responses 4% of the time or less. (Four percent also was the criterion Mednick used for remoteness although he used the Kent-Rosanoff norms; Russell and Jenkins, 1954). An original pool of 79 Palermo-Jenkins stimulus words, each with from four to eight associates meeting the 4% criterion, was shortened to 69 promising items by four judges. The 69 items were then presented to 100 (48 boys, 52 girls) rural Wisconsin sixth graders for purposes of item analysis. Using Baker and Martin's (1968) Forta, program, a 34-item test was constructed showing the following characteristics: Hoyt extimate of internal consistency = .86; median Beta (a coefficient reflecting the discrimination power of a given item = .65, with only one of the 34 items below .50 (.30 or higher is considered acceptable); a wide, non-skewed distribution of item difficulty ranging from an X_{50} of -2.26 to +2.71, where X_{50} for a given item is the point on the criterion scale, given in standard deviation units, where Ss with that score have a .50 chance of choosing the correct answer (The criterion scale in the case of the WADDLE is total score); a correlation of .33 with Kuhlman-Finch IQ scores and a correlation of .63 with Stanford Achievement Test reading scores.

An attitude questionnaire was administered to all Booklet Ss (see Appendix E).

Analysis.--Each of the six TTCT measures (Product Improvement and Unusual Uses each scored for Fluency, Flexibility, and Originality), WADDLE scores, and the Best Ideas scores was analyzed by analysis of covariance separately, in order to conserve power and simplify the analysis. Two IQ (Lorge-Thorndike verbal and non-verbal) and two language (Stanford Achievement Test vocabulary and reading) scores were used as covariates since (a) IQ has been shown to be related to creativity measures, and (b) Ss were required to read the training and control booklets.

Chapter IV

RESULTS

Table 4 shows the observed treatment means for each covariate and dependent measure. Since there were unequal, non-proportionate n's among treatments, Table 5, showing combined treatment means estimated by least squares, is more informative. Standard error estimates for each treatment x dependent measure cell also are included in Table 5.

A preliminary multivariate analysis of covariance sought to determine if scores differed between the two Torrance tests (Product Improvement, Unusual Uses), among TTCT dependent measures (Fluency, Flexibility, Originality), or among joint test x dependent measures relative to treatments. Table 6 indicates that mean performances on the two tests and the three dependent measures were not the same, and that the magnitude of such differences varied with intelligence and language scores, by school and sex, but varied little among treatment groups. Therefore, if treatments did produce variations, it should be reflected in both tests and in all three dependent measures uniformly. Accordingly, an analysis of covariance was perfcrmed on the total Torrance test scores, summing over tests and dependent measures for each S (Table 7). (Torrance (1966) instructs test users to sum over various subtests to get composite dependent measure scores. However, Harvey, Hoffmeister, Coates and White

Table 4

Observed Treatment Means

Covariates and Dependent Measures	Treatments					
	CL	FAT	Parts	PA	CWB	CWOB
Verbal I.Q.	101.95	107.10	103.00	102.43	110.53	103.95
Non-Verbal I.Q.	108.45	109.62	110.16	106.90	110.29	105.86
Vocabulary	6.00	6.53	6.26	5.16	6.66	5.91
Reading	5.89	6.05	5.63	5.66	6.30	5.34
Product Improvement						
Flu.	13.95	12.43	13.37	13.81	15.82	11.38
Flex.	6.15	6.81	7.05	6.62	7.00	6.33
Orig.	3.45	3.57	4.11	3.48	4.06	3.43
Unusual Uses						
Flu.	18.10	20.14	22.89	22.86	19.35	17.48
Flex.	7.50	9.33	8.74	8.00	7.41	8.29
Orig.	8.60	12.52	12.32	9.71	11.88	8.57
Sum over Test and Dependent Variables	57.75	64.81	68.47	64.48	65.53	55.48
WADDLE	15.20	16.81	16.11	16.24	17.00	16.38

Table 4

(continued)

Covariates and Dependent Measures	Treatments CL	FAT	Parts	PA	CWB	CWOB
Best Ideas						
Product Improvement						
Best 1 Idea	1.15	1.19	1.21	1.29	1.33	1.00
Best 2 Ideas	1.75	1.90	2.05	2.00	2.00	1.76
Best 3 Ideas	2.00	2.29	2.47	2.33	2.28	2.18
Best 4 Ideas	2.15	2.53	2.68	2.48	2.52	2.41
Best 5 Ideas	2.20	2.67	2.79	2.57	2.57	2.47
Unusual Uses						
Best 1 Idea	1.35	1.67	1.42	1.57	1.62	1.59
Best 2 Ideas	2.60	2.95	2.63	2.62	2.81	2.88
Best 3 Ideas	3.50	4.00	3.63	3.52	3.76	3.76
Best 4 Ideas	4.15	4.86	4.32	4.14	4.38	4.53
Best 5 Ideas	4.60	5.62	4.70	4.71	4.81	5.12

Table 5

Combined Treatment Means Estimated by Least Squares[1]

Dependent Measures	Treatments CL	FAT	Parts	PA	CWB	CWOB
Product Improvement						
Flu.						
w/o cov. removed	15.64	12.50	13.69	14.00	14.26	12.58
	(1.33)	(1.28)	(1.34)	(1.28)	(1.57)	(1.28)
w. cov. removed	15.18	12.55	13.59	14.21	14.40	12.75
	(1.22)	(1.17)	(1.23)	(1.17)	(1.44)	(1.17)
Flex.						
w/o cov. removed	6.81	7.00	7.18	6.63	6.82	7.08
	(.57)	(.55)	(.57)	(.55)	(.67)	(.55)
w. cov. removed	6.56	7.02	7.18	6.74	6.83	7.20
	(.53)	(.51)	(.53)	(.51)	(.62)	(.51)
Orig.						
w/o cov. removed	4.14	3.61	3.96	3.75	3.21	3.42
	(.88)	(.85)	(.89)	(.85)	(1.04)	(.85)
w. cov. removed	4.07	3.42	3.98	4.06	3.11	3.43
	(.79)	(.76)	(.80)	(.76)	(.93)	(.76)
Unusual Uses						
Flu.						
w/o cov. removed	18.78	19.50	21.13	21.25	16.43	18.61
	(3.36)	(3.24)	(3.39)	(3.24)	(3.97)	(3.24)
w. cov. removed	18.67	18.82	21.52	22.18	15.83	18.71
	(3.17)	(3.06)	(3.20)	(3.06)	(3.75)	(3.06)
Flex.						
w/o cov. removed	8.11	8.97	8.62	8.11	6.43	8.50
	(1.07)	(1.04)	(1.08)	(1.04)	(1.27)	(1.04)
w. cov. removed	8.08	8.39	8.60	8.95	6.09	8.63
	(.93)	(.91)	(.94)	(.91)	(1.01)	(.91)
Orig.						
w/o cov. removed	9.33	12.72	10.72	9.50	9.53	8.75
	(2.38)	(2.29)	(2.39)	(2.29)	(2.80)	(2.29)
w. cov. removed	8.90	11.82	11.12	10.86	8.62	9.23
	(2.13)	(2.05)	(2.14)	(2.15)	(2.50)	(2.05)

[1]Standard errors in parenthesis

Table 5

(continued)

Dependent Measures	CL	FAT	Parts	PA	CWB	CWOB
Sum over Test and Dependent Variables						
w/o cov. removed	62.81	64.31	65.29	63.25	56.68	58.94
	(7.73)	(7.45)	(7.78)	(7.45)	(9.13)	(7.45)
w. cov. removed	61.45	62.02	65.99	67.02	54.85	59.95
	(6.83)	(6.58)	(6.87)	(6.58)	(8.06)	(6.58)
WADDLE						
w/o cov. removed	16.44	17.22	16.01	16.83	17.31	17.53
	(1.37)	(1.32)	(1.38)	(1.32)	(1.62)	(1.32)
w. cov. removed	16.15	16.70	15.76	17.81	17.24	17.68
	(1.07)	(1.03)	(1.08)	(1.03)	(1.27)	(1.03)
"Best Ideas"						
Product Improvement						
1 Best Idea						
w/o cov. removed	1.18	1.15	1.21	1.33	.88	1.33
	(.58)	(.17)	(.18)	(.17)	(.21)	(.17)
w. cov. removed	1.14	1.19	1.20	1.26	.97	1.33
	(.57)	(.17)	(.18)	(.17)	(.21)	(.17)
2 Best Ideas						
w/o cov. removed	1.82	1.86	2.08	2.11	1.59	2.05
	(.99)	(.29)	(.31)	(.29)	(.36)	(.29)
w. cov. removed	1.77	1.93	2.06	1.99	1.74	2.03
	(.95)	(.28)	(.29)	(.28)	(.35)	(.28)
3 Best Ideas						
w/o cov. removed	2.12	2.25	2.58	2.47	1.95	2.41
	(1.29)	(.38)	(.41)	(.38)	(.47)	(.38)
w. cov. removed	2.05	2.33	2.51	2.35	2.17	2.35
	(1.23)	(.36)	(.38)	(.36)	(.45)	(.36)
4 Best Ideas						
w/o cov. removed	2.33	2.50	2.84	2.66	2.17	2.69
	(1.54)	(.46)	(.48)	(.46)	(.56)	(.46)
w. cov. removed	2.24	2.60	2.76	2.53	2.44	2.63
	(1.46)	(.43)	(.45)	(.43)	(.53)	(.43)

Table 5

(continued

Dependent Measures	Treatments CL	FAT	Parts	PA	CWB	CWOB
5 Best Ideas						
w/o cov. removed	2.41	2.65	2.96	2.81	2.24	2.79
	(1.78)	(.50)	(.52)	(.50)	(.61)	(.50)
w. cov. removed	2.31	2.76	2.89	2.65	2.54	2.71
	(1.58)	(.47)	(.49)	(.47)	(.57)	(.47)
"Best Ideas"						
Unusual Uses						
1 Best Idea						
w/o cov. removed	1.44	1.65	1.49	1.72	1.56	1.70
	(.50)	(.15)	(.15)	(.15)	(.18)	(.15)
w. cov. removed	1.41	1.71	1.48	1.62	1.66	1.69
	(.46)	(.14)	(.14)	(.14)	(.17)	(.14)
2 Best Ideas						
w/o cov. removed	2.74	2.89	2.76	2.90	2.77	2.98
	(.97)	(.29)	(.30)	(.29)	(.35)	(.29)
w. cov. removed	2.69	3.01	2.72	2.69	3.01	2.92
	(.87)	(.26)	(.27)	(.26)	(.32)	(.26)
3 Best Ideas						
w/o cov. removed	3.69	3.88	3.77	3.92	3.55	3.94
	(1.42)	(.42)	(.44)	(.42)	(.52)	(.42)
w. cov. removed	3.59	4.07	3.73	3.59	3.90	3.88
	(1.27)	(.38)	(.40)	(.38)	(.46)	(.38)
4 Best Ideas						
w/o cov. removed	4.39	4.71	4.51	4.60	4.22	4.59
	(1.82)	(.54)	(.56)	(.54)	(.66)	(.54)
w. cov. removed	4.25	4.93	4.43	4.21	4.67	4.51
	(1.64)	(.49)	(.51)	(.49)	(.60)	(.49)
5 Best Ideas						
w/o cov. removed	4.85	5.43	5.00	5.21	4.69	5.05
	(2.17)	(.64)	(.67)	(.64)	(.79)	(.64)
w. cov. removed	4.69	5.69	4.90	4.77	5.23	4.94
	(1.94)	(.58)	(.60)	(.58)	(.71)	(.58)

Table 6

Anaylsis of Covariance For

TTCT Difference

Scores

Source	df num.	df demon.	F	p
4 Covariates x Subtests	20	250	1.67	.04
TTCT Subtests	5	75	2.51	.04
(School; Sex; School x Sex) x Subtests	25	280	1.56	.05
Treatments x Subtests	25	280	1.15	.29
(Treatments x School; Treatments x Sex; Treatments x School x Sex) x Subtests	125	374	1.18	.12

Table 7

Analysis of Covariance

for Summed TTCT

Scores

Source	df	MS	F	p
4 Covariates	4	4231.19	5.60	.0006
Mean	1	-	-	-
School; Sex; School x Sex	5	1473.28	1.95	.10
Treatments	5	435.96	0.58	.72
Treatments x School; Treatments x Sex; Treatments x School x Sex	25	496.61	0.65	.88
Residual (error)	79	755.57	-	-

(1970) question this practice. Their results show rather strong relationships among such measures as Fluency, Flexibility and Originality and weaker relationships among the various tests).

As Table 7 indicates, the main (null) hypothesis of no treatment effects cannot be rejected. Also, inspection of interactions between Treatments and the School-Sex combination revealed no significant differences. Only the covariates were found to be related to average performance (See Appendix F for Summed TTCT & WADDLE scores by cells).

Tables 8 and 9 show the source tables for analyses of covariance for WADDLE scores and Best Idea scores, respectively. Again, only intelligence and language scores appeared to be related to Ss' performance.

Inspection of least square estimates of treatment effects (contrasts) for TTCT, WADDLE and Best Idea scores as well as the standard errors of these estimates, before and after covariate adjustment (see Table 5) indicates that covariate adjustment tended to increase some treatment effects to a small degree while moderately decreasing the standard errors of these estimates. In either case, treatment effects were small in relation to their standard errors.

Multiple R's and R^2's between the dependent measures and the four covariates are shown in Table 10. Several relationships among the dependent measures are worthy of comment and are shown in Tables 11 and 12. WADDLE correlations with the two IQ measures are in line with Mednick's (1967) data which showed correlations of about .40 for various ability measures. In the present study, WADDLE scores correlated .60 with Lorge-Thorndike verbal IQ and .56 with nonverbal IQ. Warren and Davis (1969)

Table 8

Analysis of Covariance

for WADDLE Scores

Source	df	MS	F	p
4 Covariates	4	235.86	12.62	.0001
Mean	1	87.02	-	-
School; Sex; School x Sex	5	27.80	1.49	.20
Treatments	5	4.39	0.24	.95
Treatments x School; Treatments x Sex; Treatments x School x Sex	25	15.59	0.83	.69
Residual (error)	79	18.69	-	-

Table 9

Analysis of Covariance

for "Best Ideas"

(p Values)

Source	Multivariate Tests	Univariate Tests: Prod. Impr. 1	2	3	4	5	Unus. Uses 1	2	3	4	5
Covariates	.04	.12	.05	.02	.01	.01	.01	.00	.00	.00	.00
Mean	-	-	-	-	-	-	-	-	-	-	-
School; Sex; School x Sex	.76	.54	.85	.89	.93	.91	.32	.41	.29	.41	.53
Treatments	.94	.43	.75	.82	.88	.88	.55	.97	.97	.98	.94
Treatments x School; Treatments x School x sex.	.29	.59	.29	.30	.42	.50	.10	.05	.15	.22	.28

Table 10

Multiple Correlations Comparing

Dependent Measures with

Covariates

Dependent Variable	Multiple R	R^2
Product Improvement		
Flu.	.40	.16
Flex.	.38	.14
Orig.	.44	.20
Unusual Uses		
Flu.	.34	.11
Flex.	.49	.24
Orig.	.45	.20
Sum Over Tests and Dependent Variables	.47	.22
WADDLE	.62	.39
"Best Ideas"		
Product Improvement		
1 Best Idea	.30	.09
2 Best Ideas	.34	.11
3 Best Ideas	.38	.14
4 Best Ideas	.39	.15
5 Best Ideas	.39	.15
Unusual Uses		
1 Best Idea	.41	.17
2 Best Ideas	.48	.23
3 Best Ideas	.48	.23
4 Best Ideas	.48	.23
5 Best Ideas	.48	.23

Table 11

Correlations among the Dependent Measures without Covariates Removed

		TTCT								Best Ideas									
		Prod Impr			Unus Uses					Prod Impr					Unus Uses				
		Flu.	Flex.	Orig.	Flu.	Flex.	Orig.	Sum	WAD	1	2	3	4	5	1	2	3	4	5
Prod. Impr.	Flu.																		
	Flex.	69																	
	Orig.	42	17																
Unus. Uses	Flu.	50	38	30															
	Flex.	37	41	19	72														
	Orig.	45	35	25	79	82													
	Sum	68	54	44	93	82	90												
	WAD	29	38	28	33	36	33	40											
Best Ideas-PI	1	31	08	69	33	25	32	41	23										
	2	34	07	81	29	23	30	40	22	91									
	3	37	14	87	31	24	31	44	25	87	97								
	4	37	16	87	32	22	31	44	27	83	93	98							
	5	37	16	87	31	23	33	44	28	81	92	97	99						
UU	1	27	28	16	36	63	61	52	30	34	30	25	24	25					
	2	33	30	12	42	72	69	59	33	29	26	23	20	21	91				
	3	38	33	11	49	78	74	65	34	26	23	21	19	19	85	97			
	4	39	34	12	50	80	76	67	34	24	22	21	19	20	82	94	99		
	5	39	35	14	53	83	79	70	35	23	23	21	20	21	79	92	96	99	

1 All correlations are positive.

Table 12

Correlations among the Dependent Measures with Covariates Removed

		TTCT								Best Ideas									
		Prod Impr			Unus Uses					Prod Impr					Unus Uses				
		Flu.	Flex.	Orig.	Flu.	Flex.	Orig.	Sum	WAD	1	2	3	4	5	1	2	3	4	5
Prod. Impr.	Flu.																		
	Flex.	64																	
	Orig.	33	13																
Unus. Uses	Flu.	46	32	19															
	Flex.	30	35	00	70														
	Orig.	39	27	09	77	78													
	Sum	64	48	29	93	79	88												
	WAD	08	23	02	19	12	12	17											
Best Ideas-PI	1	26	00	65	26	13	23	33	07										
	2	27	-03	80	20	09	18	30	02	90									
	3	29	02	85	21	07	18	32	04	86	96								
	4	29	04	85	22	05	18	32	05	82	93	98							
	5	28	04	85	22	06	19	32	05	80	91	97	99						
UU	1	21	22	02	28	54	53	43	13	26	20	13	12	12					
	2	29	24	-06	34	65	61	50	13	20	14	09	06	90	96				
	3	34	26	-08	42	72	68	58	13	16	10	05	02	03	82	96			
	4	34	27	-08	43	74	71	60	12	13	09	04	02	03	78	93	98		
	5	33	28	-05	46	78	74	63	12	12	09	05	03	04	74	90	95	99	

reported an IQ-WADDLE correlation of .33 with 100 sixth grade rural Wisconsin students. Also, in the present study, the WADDLE and reading score correlation (.43) was lower than the one reported by Warren and Davis (.63).

Regarding the Best Ideas measure, there are sizable correlations between Best Idea scores and TTCT total Originality scores. For example, the Product Improvement Best Idea scores for ideas 1-5 correlated .65, .80, .85, .85, and .85, respectively, with total Product Improvement Originality scores after covariates were removed. Unusual Uses Best Ideas were not quite as highly related to total Unusual Uses Originality scores, but the correlations still are .53, .61, .68, .71, and .74 with covariates removed. Product Improvement Best Idea scores and Unusual Uses Best Idea scores were not highly related to each other, however, with correlations generally from .15 to .20 between Unusual Uses Best Idea scores and Product Improvement total Originality, and from .20 to .40 between Product Improvement Best Idea scores and Unusual Uses Originality total scores. But then, the total Originality scores themselves between the two tests only correlated .25. Such a finding is consistent with the data of Harvey et. al. above, namely that correlations among the "same" dependent measures (e.g., Originality) over different tasks are often quite low.

Attitude Questionnaire mean scores and estimated standard errors (Table 13) indicated that the five groups tested did not differ significantly in their opinions regarding the booklets.

Table 13

Estimated Mean Total

Attitude Score by

Booklet Groups[1,2]

Booklet Group	Attitude Score
Checklist	24.32 (1.08)
Free Association	23.71 (1.04)
Part Changing	23.22 (1.09)
Personal Analogy	23.39 (1.04)
Control with Booklet	24.14 (1.27)

[1]30.00 = highest possible score (indicating satisfaction with booklet).

[2]Standard errors in parenthesis.

Chapter V

Discussion

Each of 119 sixth-grade Ss was assigned randomly to one of six treatment levels. The Ss in four levels read booklets which described principles of creative thinking techniques, along with presenting examples and exercises. One group read a control booklet, while another read no booklet. All Ss completed several tests. Hypotheses predicted differences among treatment levels as a function of the playfulness or organizational emphasis of the various techniques. The more playful techniques (e.g., Personal Analogy) were expected to produce higher scores on measures of Flexibility, Originality, and Best Ideas. The more organized techniques (e.g., Part Changing) were expected to produce higher scores on Fluency. No hypotheses were made regarding a convergent association measure, the WADDLE.

Results did not support these hypotheses. No treatment differences were found for any of the dependent measures, nor were there differences in the Treatment x Sex or Treatment x School interactions. Covariate (IQ & Language scores) adjustments tended to increase some treatment effects slightly while decreasing their standard errors. For all measures, treatment effects were small relative to their standard errors, before and after covariate adjustment.

However, some correlations among dependent measures were rather informative. The WADDLE, newly developed for an intermediate-age group, showed IQ correlations quite consistent (that is, in the .50 .60 range) with Mednick's (1967) data regarding older Ss over several IQ tests. WADDLE and reading correlations were somewhat lower than indicated in earlier test-development research (Warren & Davis, 1970).

WADDLE scores also correlated very low with other creativity measures. More specifically after covariates were removed, all WADDLE correlations with the six TTCT measures (i.e., two tests, each with Fluency, Flexibility, and Originality scores) and the 10 Best Ideas scores were in the .08-.23 range. Although such data are not explanatory, they do indicate that a convergent, association-type measure such as the WADDLE measures different abilities than the Torrance divergent measures. Similar findings with older Ss were reported by Davis and Belcher (in preparation) using the RAT and Torrance tests.

Best Idea scores and total TTCT Originality scores were highly correlated. This indicates that Ss' total Originality scores were strongly influenced by a small number of good ideas. Also, since total mean Originality scores were similar to total five Best Ideas scores then Best Ideas seems to be an accurate predictor of total Originality.

Results of an attitude questionnaire showed that Ss from the five booklet groups (four Experimental and one Control) had similar opinions regarding the booklets. That is, they agreed that the booklets were easy and fun to read.

The lack of differences among the present treatment levels compared to earlier studies (e.g., Cartledge & Krauser, 1963; Torrance, 1960; Warren & Davis, 1969) could be due to one or more of several factors. For example, the amount of time allowed for studying the booklets, relative to the booklets' lengths and complexity of the principles, may have been too short. Also, the timed nature of the TTCT measures could have worked against Experimental Ss who were trying to apply recently learned principles. The considerable job of applying principles learned, but very likely not overlearned, only a short time before testing could have suppressed 11- and 12-year old Ss' performance relative to Controls. In the Warren and Davis (1969) study, college-age Ss were allowed an unlimited amount of time for working on Torrance-like tasks, after learning morphological synthesis or checklist principles via a short, one or two page written explanation. Morphological Synthesis and Short Checklist groups consequently produced more high quality ideas than either Long Checklist or Control groups. Cartledge and Krauser's (1963) first grade Ss had five 20-min. training sessions prior to taking a timed product improvement exercise. Torrance's (1961) training procedures involved several days of explanation and practice with a simple product improvement technique (i.e., learning to change colors, shapes, materials, etc., for improving a stiffed bear). Both Cartledge and Krauser and Torrance treatment groups out-performed control Ss.

So, apart from inadequate time allowed for learning the training materials, other variables are of potential concern for future studies. Such parameters as mass vs. distributed practice on training materials, and mode of presenting (written, oral, first-hand experience) the techniques' principles are two examples. Also, developmental investigations are sorely needed regarding creativity training and evaluation. Tasks used for young and older Ss have often been remarkably similar (Torrance, 1966, claims his tests are useful for assessing creativity production in grade school children as well as graduate students). Certainly the organizational, metaphorical, and combinatorial abilities differ between childhood and adulthood.

The writer would like to considerably lengthen the training period and remove the time constraints on the dependent measures. A study incorporating these goals, to take place in England, is presently in the planning stages. It will involve having trained interns teaching principles of creativity techniques to technical school Ss over a period of several weeks. An attempt will be made to assess groups by way of rather complex tasks with both divergent and convergent requirements as well as through conventional evaluation.

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Appendices

Appendix A

Long Checklist

(from Davis & Houtman, 1968)

Long Checklist

(From Davis & Houtman, 1968)

Change Color?

Blue
Green
Yellow
Orange
Red
Purple
White
Black
Olive Green
Grey
Brown
Tan
Silver
Gold
Copper
Brass
Plaid
Striped
Polka-dotted
Flowers
Speckles
Paisley
Pop Art
Other Colors?
Color Combination?
Other Patterns?

New Size?

Longer
Shorter
Wider
Fatter
Thinner
Thicker
Higher
Lower
Larger
Smaller
Jumbo
Miniature
Other Size?

Change Shape?

Round
Square
Triangle
Oval
Rectangle
5-Sided
6-Sided
8-Sided
10-Sided
Lop-Sided
Sharp Corners
Round Corners
Egg-Shaped
Doughnut-Shaped
"U" Shaped
Other Shapes?

New Material?

Plastic
Glass
Fiberglass
Formica
Paper
Wood
Aluminum
Nylon
Cloth
Gunny Sack (Burlap)
Cardboard
Steel
Leather
Copper
Rubber
Other Material?
Combination of These Materials?

Add or Subtract Something

Make Stronger
Make Faster
Exaggerate Something
Duplicate Something
Remove Something
Divide
Make Lighter
Abbreviate
Add New Do-Dad
Add New Smell
New Sound
New Lights
New Flavor
New Beep Beep
New Jingle Jingle
Subtract The Thing That Doesn't Do Anything

Rearrange Things?

Switch Parts
Change Pattern
Combine Parts
Other Order of Operation
Split Up
Turn Backward
Upside Down
Inside Out
Combine Purposes
Other Switcheroo?

New Design?

From Other Countries?
Oritental design
Swedish design
Mexican design
French design
Eskimo design
Russian design
American design
Indian design
Egyptian design
Spanish design

From Other Time?
Old West
Roaring Twenties
Past Century
Next Century
Middle Ages
Cave Man
Pioneer

From Other Styles?
Hippie
Beatnik
Other Wierdos
Ivy League
Secret Agent
Elves and Fairies
Clown
Football Uniform

Appendix B

Training Booklets

CHECKLIST BOOKLET

This book is about ideas. When you finish reading it, you will know how to think of more good ideas. Here is why you will be able to think of more good ideas:

You will know that borrowing from older ideas can help you think of new ideas. People always borrow some ideas when they think of new ones. Ideas can be borrowed from many places.

You should have fun reading the book and thinking of ideas.

Other students have tried to name new things. Here are some of them: maxi coats, jumbo jet planes, blow up furniture and soup can furniture, snowmobiles, wide ties, double breasted suits and others.

"Nothing is new," people sometimes say. Do you agree with them? Try to name something that is really new. Write it here.

The people who first thought of these things borrowed ideas from older things. Maxi coats, wide ties, and double breasted suits were borrowed from many years ago when people wore them. The "new" jumbo jet idea was borrowed from smaller and older planes and also from ocean liners. Blow up furniture was borrowed from beach balls, air mattresses and other furniture. Snowmobiles came from motorcycles and sleds. (We don't know where soup can furniture came from.)

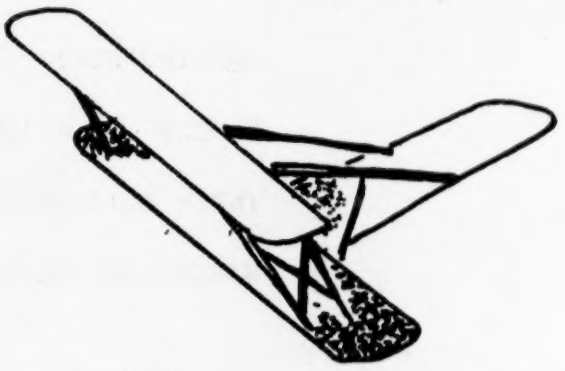
It's not wrong to say these things are new. It is helpful, though, to know that they are like other things that are not new. It is helpful to borrow ideas. Borrowing from other ideas can help us think of new ideas.

Borrowing is not the same as copying, because when we borrow, we change something.

Thomas Edison invented the electric light. But many others have borrowed from his invention. They have improved electric lights. Of course, Edison borrowed from others too.

Shakespeare, a great writer of long ago, borrowed ideas from other stories. Recent writers have borrowed from Shakespeare's stories.

Inventors always borrow some ideas when they are thinking of new things. The Wright brothers first made an airplane with



a motor. But they said that they borrowed ideas. They borrowed ideas from inventors in Germany who worked with glider planes.

Borrowing ideas can be helpful in school. A student, Roger, used borrowing to help him with a class assignment. His teacher asked the class to write stories. They could choose anything to write about. Most students couldn't think of good ideas. Roger had more than he could use. Here is why!

He looked at headlines in newspapers and borrowed ideas from them. Here are some headlines he saw:

SMOKING MIGHT CAUSE CANCER

FAMOUS BEACH COVERED WITH OIL

THREE POLICEMEN PLAY A JOKE ON THEIR CHIEF

WISCONSIN INDIANS ARE ANGRY

One day Pete went looking for adventure. On the way he met Esmeralda taking a sunbath. She decided to go with him. They planned to raid Rabbit Den No. 5. When they arrived, the place was a shambles and there were signs of struggle.

Ideas for stories can be borrowed from these headlines. Look at them again. What stories do the headlines suggest? Write about one of the stories that you think of by borrowing from the headlines. Remember, you should first get your idea from the headlines, but you should change it.

Write on the next page too.

Here are some stories that have been borrowed from the newspaper headlines. Other students thought of them.

Headline: SMOKING MIGHT CAUSE CANCER

Students' stories: "Smoke From House Leads Girl to Children" (A story about a girl who saves lives.) "What if Snow Caused Fires?" (A story about falling snowflakes that were red hot.)

Headline: FAMOUS BEACH COVERED WITH OIL

Students' stories: "Clams Snap at Sun Bathers." (A story about clams closing shut on people who spread their blankets over them at a beach.) "Snow Covers City." (A story about what happened to three girls on the day school was closed because of a big snowstorm.)

Roger's story borrowed from the headline WISCONSIN INDIANS ARE ANGRY. The title of his borrowed story was, "Pet Parrot Gets Mad." The story told about a parrot who wanted a larger cage. His owner wouldn't give it to him. So, the parrot stopped talking except at night when the owner was sleeping. Then he screeched out what time it was every hour. Only he said the wrong hour (on purpose) every time. He soon had a larger cage.

Headline: THREE POLICEMEN PLAY A JOKE ON THEIR CHIEF

Students' stories: "Three Teachers Trick the Principal." (A story about teachers having fun.) "Two Policemen Arrest Each Other." (A story about a mix-up in the police department.)

Roger's story was different from the one about the Indians. It really did come from that headline though. Instead of angry Indians he thought of an angry parrot. The idea was borrowed.

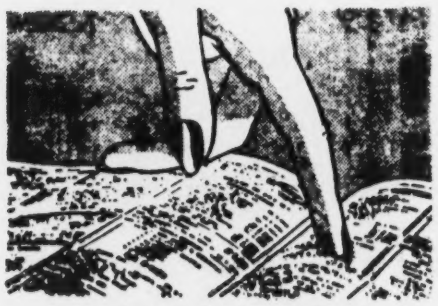
It's not hard to see how the students got their ideas, is it? Try to think of one more story for each headline now that you have seen other students' answers. Write in the space after each headline.

Here are the headlines again along with some other ones.

SMOKING MIGHT CAUSE CANCER

FAMOUS BEACH COVERED WITH OIL

THREE POLICEMEN PLAY A JOKE ON THEIR CHIEF



Ideas can be borrowed from other places too. The Yellow Pages of a telephone book is such a place. The Yellow Pages helped a group of students find "new things to do" after school, Saturdays and during the summer. Some of the things to do could earn extra money for the students.

They looked at the Yellow Pages and borrowed these ideas:

WISCONSIN INDIANS ARE ANGRY

DAM BREAKS IN SOUTH AMERICA

MORE HEART TRANSPLANTS THIS YEAR

MOONMEN START BACK

ENGLAND TO SAVE RETIRED HORSES

"Help clean up yards and garages before people move." (The Yellow Pages said "Moving.")

"Play checkers, chess, and other games with people who are in nursing homes." (The Yellow Pages said "Nursing Homes.")

"Walk dogs or baby sit for dogs and other pets." (The Yellow Pages said "Pets.")

"Do garden work such as pull weeds." (The Yellow Pages said "Garden Centers.")

"Make picnic lunches to sell in parks and at beaches." (The Yellow Pages said "Picnic Supplies.")

Bulk Milk Coolers—See
Barn Equipment; also **Dairy Equipment & Supplies**; also **Farm Equipment**; also **Farm Supplies**; also **Refrigerating Equipment-Commercial**
Bulldozing—See
Excavating Contractors
Bullet Holders—See
Police Equipment
Bumpers-Automobile—See
Automobile Bumpers & Grilles
Bumpers-Dock—See
Dockboards & Ramps; also **Material Handling Equipment**; also **Rubber Products**
Bumpers-Hitches—See
Automobile Parts & Supplies-New; also **Trailers-Equipment & Parts**
Bunk Beds—See
Beds; also **Furniture** headings
Bunting—See
Flags & Banners
Bureaus—See
specific kinds such as **Inspection Bureaus**; also **Travel Bureaus**
Burglar Alarm Systems
Burglar Protective Equipment—See
Burglar Alarm Systems; also **Locksmiths**
Burglary Insurance—See
Insurance
Burial Plots—See
Cemeteries
Burial Vaults
Burlap-Wall—See
Wallpapers-Retail
Burners—See
Gas Burners; also **Oil Burners**
Burnishing—See
Plating
Bus Boys' Uni
Unifor
Butcher Shops—See
Meat-Retail
Butchers' Equipment & Supplies
Butchers' Linen—See
Linen Supply Service; also **Towel Supply Service**
Butter
Buttermilk—See
Dairies
Buttonhole Machines
Buttons-Advertising & Campaign—See
Badges; also **Advertising Specialties**

C

Cabanas-Builders—See
Building Contractors; also **Buildings-Metal**; also **Carpenters**; also **Contractors-General**; also **Home Builders**
Cabarets—See
Cocktail Lounges; also **Restaurants**; also **Night Clubs**
Cabinet Makers
Cabinets
Cable—See
Wire Rope
Cable Tray Systems—See
Electric Equipment
Cables-Speedometer—See
Speedometers
Cabling-Tree—See
Tree Service
Cabs—See
Taxicabs
Cadmium Plating—See
Plating
Cafes—See
Restaurants; also **Night Clubs**
Cafeterias—See
Restaurants
Cages—See
Equipment
Canoes—See
Boat Dealers
Canopies—See
Awnings & Canopies
Cans
Cans-Metal—See
Cans
Cantonese Foods—See
Chinese Foods; also **Restaurants**
Canvas Covers—See
Canvas Goods; also **Tarpaulins**
Canvas Goods
Cap Screws—See
Screws
Capital Loans—See
Banks; also **Financing**; also **Loans**
Caps-Uniform—See
Uniforms
Car Air Conditioning—See
Automobile Air Conditioning Equipment
Car Batteries—See
Batteries
Car Dealers—See
Automobile Dealers headings
Car Equipment—See
Automobile Parts & Supplies-New
Car Ferries—See
Ferries
Car-Foreign—See
Automobile Dealers headings
Car-Golf—See
Golf Cars & Carts
Car Heaters—See
Heaters-Automotive
Car Hitches—See
Automobile Parts & Supplies-New; also **Trailers-Equipment & Parts**
Car Insurance—See
Insurance
Car Keys—See
Keys; also **Locksmiths**
Car Leasing—See
Automobile Renting &
Card Holders—See
Wire Products
Card Indexing Systems—See
Filing Equipment, Systems & Supplies; also **Loose Leaf Equipment, Systems & Supplies**
Card Laminations—See
Laminations-Plastic, Paper, Etc.
Card Tables—See
Furniture Dealers-Retail; also **Tables-Folding**
Cardiographic Equipment—See
Pharmacies; also **Physicians' & Surgeons' Equipment & Supplies**
Cards-Greeting—See
Greeting Cards-Retail
Career Guidance—See
Personnel Consultants; also **Vocational Guidance**
Carillons—See
Chimes & Bells
Carnival Supplies
Carousels—See
Amusement Devices
Carpenters
See also **Building Contractors**; also **Contractors-General**; also **Home Builders**
Carpet Cleaning Compounds—See
Cleaning Compounds
Carpet Layers
Carpet & Rug Cleaners
Carpet & Rug Cleaning Equipment-Rental
Carpet & Rug Cleaning Equipment & Supplies
Carpet & Rug Dealers-New
Carpet & Rug Distrs & Mfrs
Carpet & Rug Pads, Linings & Accessories
Carpet & Rug Repairing
Carging—See
Layers; also

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So far we have talked about two places where we can borrow ideas . . . newspaper headlines and the Yellow Pages. Both of these are like lists of ideas to borrow from.

The students said the Yellow Pages really helped.

Now you try something like this. Your job will be harder since you won't have a telephone book. You'll just have a page from the Yellow Pages. Try to think of new things to do. Borrow ideas from this page.

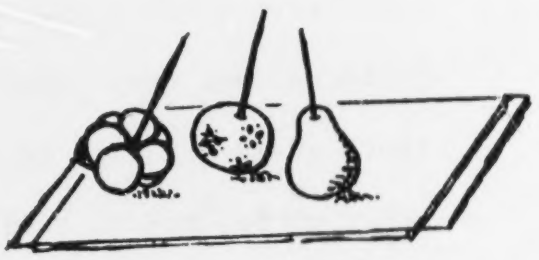
We can borrow ideas from other places too. Students have said that we can also borrow ideas from dictionaries, encyclopedias, magazines, catalogs, and by just walking through a department store and noticing all the different things. Dictionaries, encyclopedias, magazines, and catalogs are all like lists of ideas. Try to think of one more list of ideas. In other words, try to think of one more place where you can borrow ideas. Write it here.

Some people have made up lists. These lists help us think of ideas. They give clues or hints. It is quite easy to borrow ideas from one of these lists.

Here is a list that someone has made up. The list is very helpful for someone who is making something.

Add or subtract something.
Change color
Change the materials.
Change the parts around.
Change shape.
Change size.
Change the design or style.

By carving the apple (like a halloween pumpkin), she changed its shape. She used tiny apples (size change) and stuck many of them together. Finally, Sonja made designs on the taffy apples from sunflower seeds.



She told her father about the list and he thought she was very smart to use it.

A girl, Sonja, used this list to make many new and different "taffy apples." Her father owned a candy store, and she worked there after school.

She added an arrow through the apple. This made a William Tell taffy apple. She subtracted the seeds to make a taffy apple that could be completely eaten.

By using a pear instead of an apple, she changed the material. She cut up the long stick to make a "man" with arms and legs. In other words, she changed the parts.

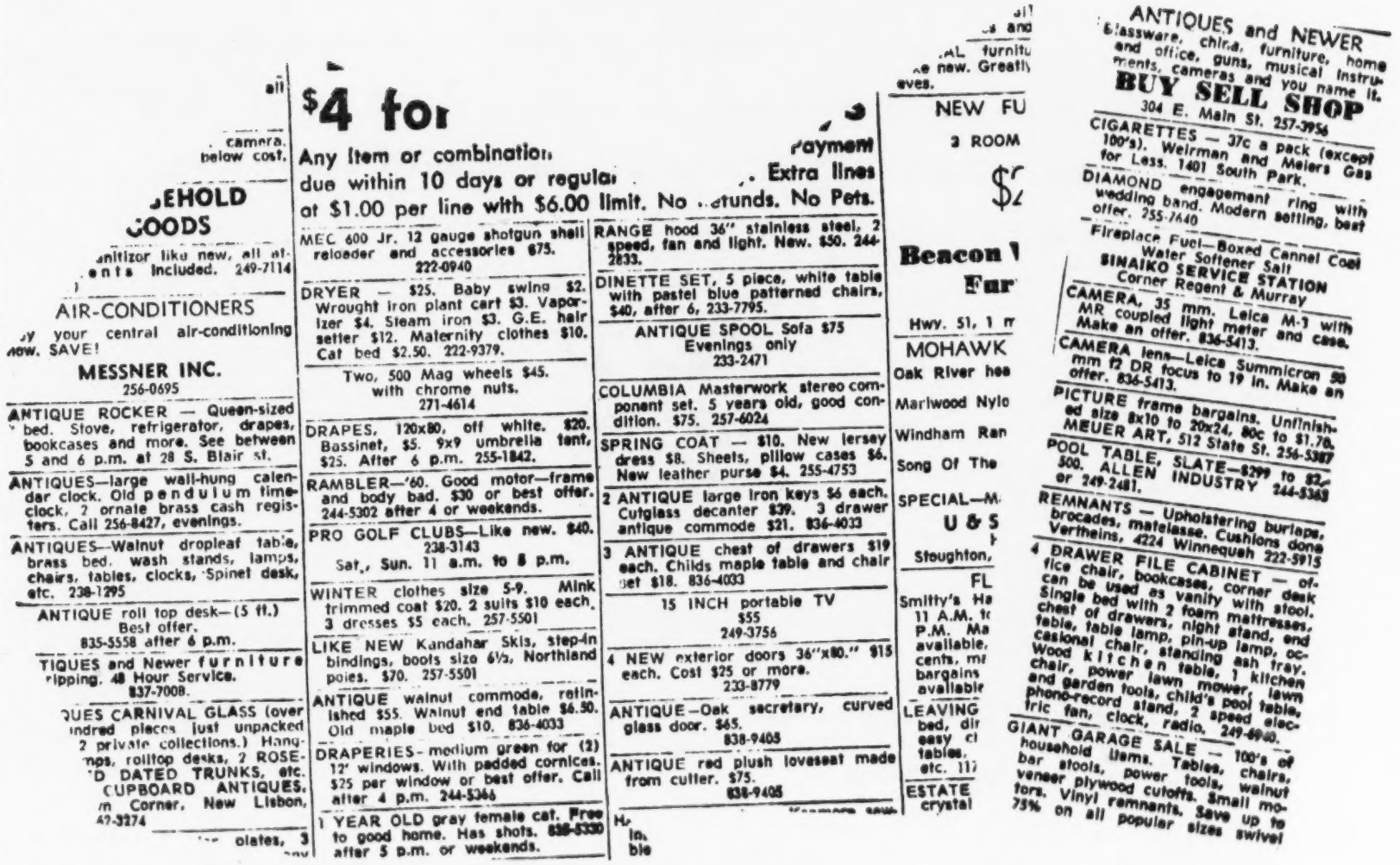
We can borrow from this list too. If our problem is like an inventor's, and we are making things, the list will be helpful. It also could help us think of a story or a new kind of food.

Remember, it is helpful to borrow ideas. Borrowing is not the same as copying because when we borrow, we change something.

SKIP THE NEXT BLANK PAGE.

Here is another list. You can use it to borrow ideas too. Maybe you have seen something like this before. It is taken from the want ad section of a newspaper.

Use the list to help you think of interesting gifts to give people. Try to think of gifts that won't cost very much. Remember to borrow, not copy. Write your gift ideas here.



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camera.
below cost.
EHOLD
OODS
anitizor like new, all at-
ents included. 249-7114
AIR-CONDITIONERS
by your central air-conditioning
now. SAVE!
MESSNER INC.
256-0695
ANTIQUE ROCKER — Queen-sized bed. Stove, refrigerator, drapes, bookcases and more. See between 5 and 6 p.m. at 28 S. Blair st.
ANTIQUES—large wall-hung calendar clock. Old pendulum time-clock, 2 ornate brass cash registers. Call 256-8427, evenings.
ANTIQUES—Walnut dropleaf table, brass bed, wash stands, lamps, chairs, tables, clocks, Spinet desk, etc. 238-1295
ANTIQUE roll top desk—(5 ft.) Best offer. 835-5558 after 6 p.m.
TIQUES and Newer furniture ripping. 48 Hour Service. 837-7008.
QUES CARNIVAL GLASS (over ndred pieces just unpacked 2 private collections.) Hang-ps, rolltop desks, 2 ROSE-D DATED TRUNKS, etc. CUPBOARD ANTIQUES, n Corner, New Lisbon, 42-3274
plates, 3
$4 for
Any item or combination
payment
due within 10 days or regula
. Extra lines
at $1.00 per line with $6.00 limit. No refunds. No Pets.
MEC 600 Jr. 12 gauge shotgun shell reloader and accessories $75. 222-0940
DRYER — $25. Baby swing $2. Wrought iron plant cart $3. Vaporizer $4. Steam iron $3. G.E. hair setter $12. Maternity clothes $10. Cat bed $2.50. 222-9379.
Two, 500 Mag wheels $45. with chrome nuts. 271-4614
DRAPES, 120x80, off white. $20. Bassinet, $5. 9x9 umbrella tent, $25. After 6 p.m. 255-1842.
RAMBLER—'60. Good motor—frame and body bad. $30 or best offer. 244-5302 after 4 or weekends.
PRO GOLF CLUBS—Like new. $40. 238-3143 Sat., Sun. 11 a.m. to 8 p.m.
WINTER clothes size 5-9. Mink trimmed coat $20. 2 suits $10 each. 3 dresses $5 each. 257-5501
LIKE NEW Kandahar Skis, step-in bindings, boots size 6½, Northland poles. $70. 257-5501
ANTIQUE walnut commode, refinished $55. Walnut end table $6.50. Old maple bed $10. 836-4033
DRAPERIES- medium green for (2) 12' windows. With padded cornices. $25 per window or best offer. Call after 4 p.m. 244-5366
1 YEAR OLD gray female cat. Free to good home. Has shots. 838-5330 after 5 p.m. or weekends.
RANGE hood 36" stainless steel, 2 speed, fan and light. New. $50. 244-2833.
DINETTE SET, 5 piece, white table with pastel blue patterned chairs, $40, after 6, 233-7795.
ANTIQUE SPOOL Sofa $75 Evenings only 233-2471
COLUMBIA Masterwork stereo component set. 5 years old, good condition. $75. 257-6024
SPRING COAT — $10. New jersey dress $8. Sheets, pillow cases $6. New leather purse $4. 255-4753
2 ANTIQUE large iron keys $6 each. Cutglass decanter $39. 3 drawer antique commode $21. 836-4033
3 ANTIQUE chest of drawers $19 each. Childs maple table and chair set $18. 836-4033
15 INCH portable TV $55 249-3756
4 NEW exterior doors 36"x80." $15 each. Cost $25 or more. 233-8779
ANTIQUE—Oak secretary, curved glass door. $65. 838-9405
ANTIQUE red plush loveseat made from cutter. $75. 838-9405
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crystal
ANTIQUES and NEWER
Glassware, china, furniture, home and office, guns, musical instruments, cameras and you name it.
BUY SELL SHOP
304 E. Main St. 257-3956
CIGARETTES — 37c a pack (except 100's). Weirman and Meiers Gas for Less. 1401 South Park.
DIAMOND engagement ring with wedding band. Modern setting, best offer. 255-7640
Fireplace Fuel—Boxed Cannel Coal
Water Softener Salt
SINAIKO SERVICE STATION
Corner Regent & Murray
CAMERA, 35 mm. Leica M-3 with MR coupled light meter and case. Make an offer. 836-5413.
CAMERA lens—Leica Summicron 50 mm f2 DR focus to 19 in. Make an offer. 836-5413.
PICTURE frame bargains. Unfinished size 8x10 to 20x24, 80c to $1.70. MEUER ART, 512 State St. 256-5387
POOL TABLE, SLATE—$299 to $2 500. ALLEN INDUSTRY 244-5363 or 249-2481.
REMNANTS — Upholstering burlaps, brocades, matelasse. Cushions done Vertheins, 4224 Winnequah 222-5915
4 DRAWER FILE CABINET — office chair, bookcases, corner desk can be used as vanity with stool. Single bed with 2 foam mattresses, chest of drawers, night stand, end table, table lamp, pin-up lamp, occasional chair, standing ash tray. Wood kitchen table, 1 kitchen chair, power lawn mower, lawn and garden tools, child's pool table, phono-record stand, 2 speed electric fan, clock, radio. 249-6940.
GIANT GARAGE SALE — 100's of household items. Tables, chairs, bar stools, power tools, walnut veneer plywood cutoffs. Small motors. Vinyl remnants. Save up to 75% on all popular sizes swivel

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Once a teacher asked the class, "What inventions do you think we will see in the future?" The students were very quiet except for one boy, Grant. He thought of more inventions than the whole class put together.

He thought of: (1) a soap that doesn't need water; (2) clothes that don't wear out; (3) chalk that stays on the board for a certain time, and then disappears; (4) a collapsible comb; and (5) desks up in the air attached to walls.

His secret was simple. He looked at things in the room and borrowed ideas from them. He looked at hands, clothes, chalk, a comb, and desks. This is one more way to borrow ideas. Just look at the things around you.

Right now look at the many different things in this room. When you are in a different room, or outside, you will see more things to help you get ideas.

Write on this page too.

Now you try to think of more inventions of the future. Do it by looking around you. Who knows, maybe you will invent one of them someday. Write your ideas here and on the next page.

A look back . . .

Borrowing from older ideas can help you think of new ideas. Inventors always borrow at least some ideas when they think of new things.

Borrowing is not the same as copying, because when you borrow, you change something.

Ideas can be borrowed from many places. One of the best ways to borrow is by looking at the things around you.

FREE ASSOCIATION TECHNIQUE BCOKLET

This book is about ideas. When you finish reading it, you will know how to think of more good ideas. Here is why you will be able to think of more good ideas:

You will know that the last ideas you think of will often be the best ones. The first ideas must get out of the way. Then the best ideas can appear.

You should have fun reading the book and thinking of ideas.

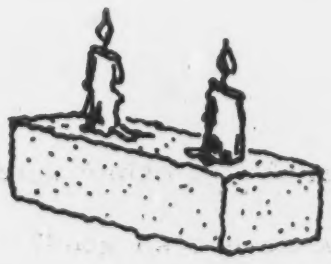
One boy, Jason, noticed that, "Our best ideas come last. It's almost like we have to get the first ideas out of the way. Then the good ones can show up."

Let's see what he means. We will list the ideas for earning money in the same order that students said them.

1. Baby sitting.
2. Paper route.
3. Selling things.
4. Making things.
5. Become a teacher.
6. Clean sewers.
7. Make candlestick holders.

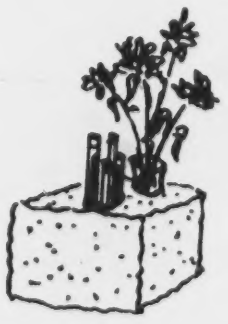
One day some students were talking about new ways for them to earn money. Everyone thought of at least one way, and some students thought of many ideas.

Can you think of a new way for students your age to earn money? If you can, write it here.



8. Make a candlestick holder out of bricks.

9. Make a pencil holder out of a brick. Paint it and sell it.



10. Use one brick for both a pencil holder and a flower holder. It would look nice on a desk.

11. Make a door stopper out of a brick. We could put cloth or some other covering around the brick.

12. Use two bricks or one brick broken in half. One half could be a pencil holder or flower holder; the other half could be a paperweight. Cloth or leather could be put around the parts. They would make a matching set for a desk.

How would you rate these ideas? In other words, which ones are the good ones, and which ones aren't so good? Write the numbers of the best three ideas here:

_____ _____ _____

13. I think bricks could be used to make weights for lifting. Sticks or rods could be put through the holes in the bricks. More bricks could be added to make them heavier. Bricks could be taken off to make them lighter.

Jason was right. The best new ideas came last. The first ideas that students thought of were baby sitting and paper routes. They aren't new ideas though. If a student can think of a new money making idea, he will have a very good chance to earn a lot of money that way. This is because he will be the only one doing that job.

Let's go back and look at the list of ideas again. This time we'll tell you what the students said or did when each idea was mentioned.

1. Baby sitting (moans, groans, and two "Oh no's").
2. Paper route (fewer moans and groans; no "Oh no's").
3. Selling things (silence).
4. Become a teacher (many moans, groans, "Oh no's," and ick's" plus a "What's the matter with that?").

5. Cleaning sewers (many "ick's" plus much hand-clapping and cheering).
6. Make candlestick holders (silence).
7. Make candlestick holders from bricks (one long drawn out "Yeah" and some pleased looks).
8. Pencil holders made from bricks (about the same as number 7).

After ideas 7 and 8 almost everyone started talking about brick ideas. One student's idea would remind another student of something like it. Everyone had ideas. The ideas just didn't come out at first. Later they did.

We use only a few of our ideas. The rest are hidden in our heads. These ideas are not used.

The ideas that we first think of often won't be our best ones. The hidden ideas are usually better.

Most ideas are hidden in our heads. There are ways of finding the hidden ideas. A teacher, Mr. Fist, knew one way. He used it with his class. His class was like yours.

We all have some ideas that we think or talk about. We also have ideas that are hidden in our heads.

Our ideas are like an iceberg. We see only a small part of an iceberg. The rest is below the water.

Mr. Fist and his class were talking about inventions. A student said, "Someone should invent better ways for cleaning our teeth." Everyone agreed. Children don't like to brush teeth. Parents don't like dentist bills. Children don't want to go to the dentist.

Mr. Fist thought that new teeth cleaning inventions could be made. So he and the whole class talked about it.

Mr. Fist was good at thinking of ideas. He knew that best ideas often come last. He wanted students to get rid of their other ideas right away. Then the good ones could appear.

He started like this. "I'm going to say a word. You say words that my word reminds you of.

Mr. Fist then said "eating."

Before going any farther, you list the words that "eating" reminds you of.

_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

Next Mr. Fist did the same thing with the word "clean."

Now you write the words "clean" reminds you of.

_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

These are the words the students said. They are listed in the same order that the students said them. Mr. Fist wrote the words on the board as the students said them.

1. food	6. sleeping	11. taste
2. hungry	7. spoon	12. chew
3. drinking	8. supper	13. fat
4. ate	9. good	14. fun
5. full	10. table	15. stuffed

These are the words the students said. They are in the same order that the students said them.

1. dirty	7. fingernails	13. smooth
2. white	8. shiny	14. squeeky
3. neat	9. sparkle	15. fluffy
4. dust	10. scrub	16. pure
5. house	11. car	17. healthy
6. water	12. polish	18. shovel

At this point, Mr. Fist backed up a few steps from the board and looked at the two lists. Then he walked up and drew circles around some words on each list. He circled "good" and "fun" from the first list. From the second list, he circled "scrub," "polish" and "shovel." Notice what numbers each of these words were. The ideas he circled were some of the last ones on the list.

"That's a good idea," said Mr. Fist. "Then people would gladly do it."

"Why do you think I circled "scrub," "polish" and "shovel" on the second list?" Mr. Fist asked.

What do YOU think? Why did he circle these words?

"We're looking for new and better ways of cleaning teeth. Right?" Mr. Fist asked the class.

"R I G H T!"

"I think the words I have circled might help us. How can "good" and "fun" tell us something about our new teeth cleaner?"

"Well," said Joan, "teeth brushing isn't fun. I suppose it's good for you though."

Harry kind of shouted out, "We should make teeth cleaning as much fun as eating."

Here is what some of his students said.

"Those are all ways of cleaning things, aren't they?" Dave answered.

"Sure," said Mr. Fist. Then he added, "We all can scrub and polish our teeth, but does it make sense to shovel our teeth?"

Nobody said anything for a while. Then Vera spoke up, "I saw a TV commerical where little men were shoveling out snow from a tire."

"Real men?" Mr. Fist asked.

"Nooooo," many students said at once.

Then Dave explained. "They were trying to sell snow tires. The little men were shoveling out the treads of the tires. It was some kind of trick photography. It's just a way of showing that the tire cleans itself."

"Could a commercial for tooth paste have little people shoveling out between teeth?" Mr. Fist asked.

"Sure," a few students answered, but no one said much.

The Object That is Cleaned	How It is Cleaned
Car	Wash; Use a special cleaner.
Floor	Vacuum cleaner; Sweep special dust-like stuff.
Sidewalk	Sweep; Shovel (snow).
Paper	Erasers; Ink remover.
Trees and bushes	Rain; Wind.

These are the first five objects and cleaning methods that students suggested. What would you add? Write your ideas here.

"Let's try something just a little bit different," said Mr. Fist. "Name some objects and then tell how they are cleaned. Maybe we can learn something about cleaning teeth by looking at other things. For example, a house may be cleaned by painting or by washing.

The students had many ideas. This is the order they came in.

Here are the rest of the ideas the students had.

Clothes	Wash; Dry clean with chemicals.
Fingernails	Scrape; Brush.
Windows	Wipers; Washers.
Car motors	Air (at high pressure).
Aquariums/fish bowls	Filters; Snails.
Animals	They lick themselves and each other.
Flowers	Little insects.
Clothes (someone said it again)	Those sort of living things (enzymes).
Burned people	Little worms (maggots).
Barns	Cats.

Look at the last six ideas. They all are about how living things clean other things.

What other living things are cleaners? Try to name one or two. Write them down here.

Some of the ideas you think about when you are alone will be good. Others won't be as good. The first ones you think about might not be as good as the last ones. The first ones have to get out of the way so the best ones can come out.

Mr. Fist's class didn't really invent a new kind of teeth cleaner that day. They did have some good ideas though. The idea most people liked best was, "Put living things in tooth paste. They can eat the waste food. Maybe we could then brush teeth only once a week or so."

Someone might really invent something like this sometime. We have said that first ideas often are not the best ones. You have read about groups of students who were thinking of new ideas. When you are alone you can think of new ideas too. The last ideas you think of when you are alone will often be the best ones.

A look back . . .

You should not stop trying when you have thought of only a few ideas. The last ideas you think of will probably be your best ones.

The ideas you first think of often won't be your best ones. The first ideas must get out of the way. Then the best ideas can appear.

PART CHANGING BOOKLET

This book is about ideas. When you finish reading it, you will know how to think of more good ideas. Here is why you will be able to think of more good ideas:

You will now that amost everything has parts, and parts can be changed. Changing parts is a good way to think of new things and ideas.

You should have fun reading the book and thinking of ideas.

Here is a list of some more things. Some parts are given to you. Others are not. Try to add some more parts.

Bicycle: seat, wheels, _____, _____,
_____.

House: roof, walls, _____, _____,
_____.

Town or city: streets, buildings, _____, _____,
_____.

Classroom: blackboard, desks, _____, _____,
_____.

Almost everything has parts. Some parts of a car are wheels, motor, doors, seats, and windows. Some parts of a shoe are heel, sole, laces or buckles, and shape. Parts of a dress are buttons, sleeves, pockets, and colors. Parts of a bottle are its shape, size, and cap or cover.

One student listed these parts. Sue said,

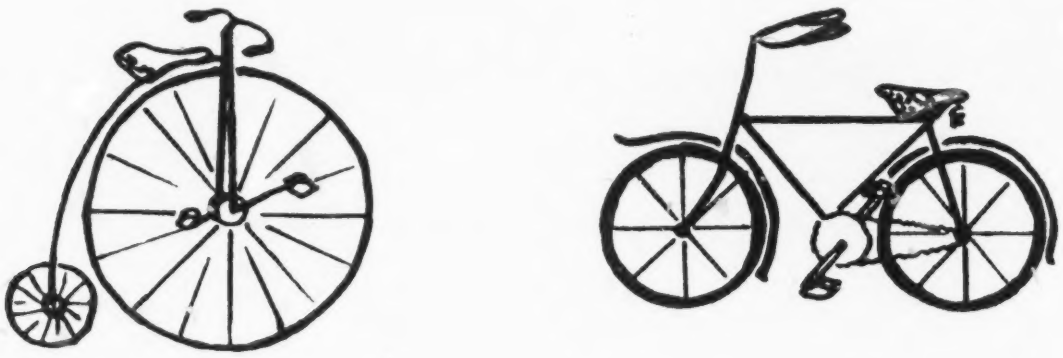
Bicycle: lights, baskets, pedals, chain.

House: doors, windows, porch, shape.

Town or city: parks, airports, sewers.

Classroom: clocks, bookshelves, cupboards, floor.

Parts can be changed. A bicycle's parts have changed in the last 75 years or so. The wheel part has been big, small, or in between.



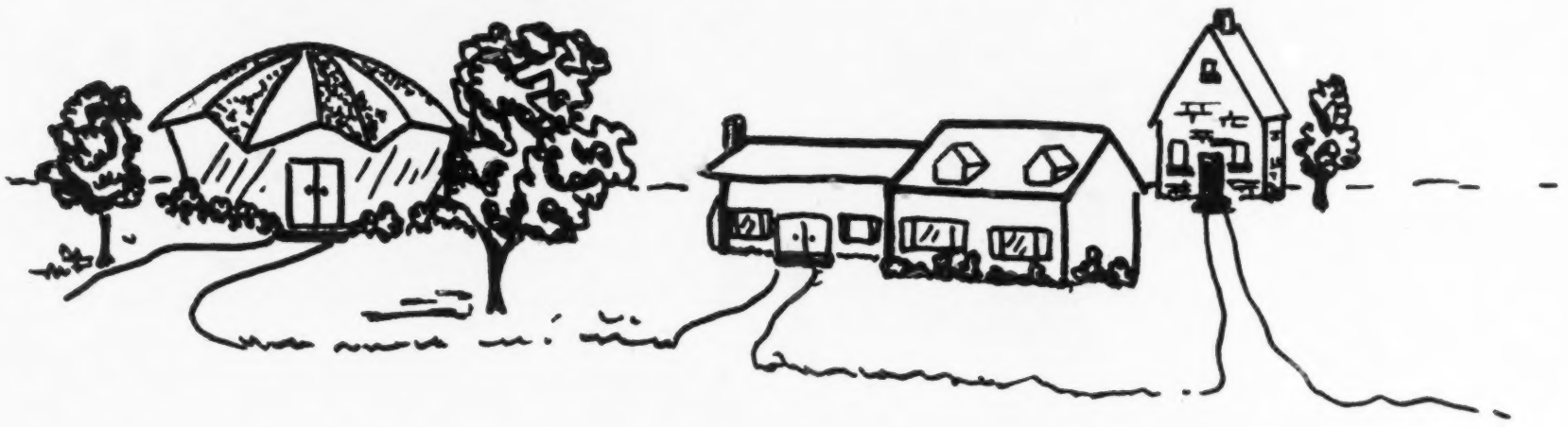
The seat part has had different shapes. So has the handlebar part.

Parts of coats change. The color part can be blue, red, green, orange, black, or just about anything. The button part can be big, small, round, square, metal, or wood. The material part (This means what the coat is made of) can be wool, cotton, rubber, nylon, or leather.

Here are the parts of some things. You write how the parts can be changed. We have given you a start on some:

Pencil's Parts	Changes for the Parts
eraser	bigger, smaller, flatter, _____, _____, _____, _____, _____
material	wood, metal, _____, _____, _____.
shape.	long and narrow, short and fat, hand-shaped _____, _____, _____

The parts of houses also change and become different. Roof parts can have many shapes and sizes. The walls can be made of many



different things such as wood, brick, or metal. The heating part can use oil, gas, coal, or wood.

Chair's Parts	Changes for the Parts
seat	bigger, softer, _____, _____, _____.
legs	with wheels, with rockers, long, short, _____, _____, _____.
back	high, wide, _____, _____, _____.

Wristwatch Parts	Changes for the Parts
the clock part	round, square, silver, _____, _____, _____.
the band or strap.	leather, stretch, snake shaped, wide, _____, _____, _____.

Chair's Parts	Changes for the Parts
seat	with holes, many little cushions, saddle shaped.
legs	with suction cups, made from big springs, use big bottles.
back	bends, fits a person's body, rubber.

Another student, Marvin, wrote these changes:

Pencil's Parts	Changes for the Parts
eraser	colorful, diamond shaped, square.
material	plastic, glass, clay.
shape	cookie shaped, gun shaped, arrow shaped.

Wristwatch Parts	Changes for the Parts
the clock part	plastic, ball shaped.
the band or strap.	made from straw, buttons onto shirt.

Kitchens also have parts. Kitchens have parts of floors, windows, sink, stove, refrigerator, and others. What are some changes for a kitchen?

Kitchen Parts	Changes for the Parts
floors	
windows.	
sink	
stove.	
refrigerator	

Knowing about parts can be helpful. If we know the parts of something, we can change them. Changing parts is a good way to improve things. It is also a good way to invent new things.

Let's try to invent some new golf bags by changing parts. The picture shows an ordinary golf bag. Pretend you work for a company that sells golf bags. The company wants to have new kinds of golf bags to sell. Your job is to invent new kinds of golf bags.

Other students have said:

Kitchen Parts	Changes for the Parts
floors	rugs in kitchens, self-cleaning, sponge rubber.
windows	different shapes, colors like church windows, self-cleaning.
sink	made of soft material, made into a dish washer, with sides so water can't spill.
stove.	cooks without heat, all things like pots go inside.
refrigerator	lighter weight, see through.

Let's look at only two parts of golf bags: (1) the shape of the bag, and (2) the kind of material it is made of. Some new golf bag shapes might be: triangle shaped, test tube shaped, cannon shaped, octopus shaped, garbage can shaped, and round shaped.

New materials for a golf bag could be: straw, wood, silk, fishnet, rubber, cardboard, and glass.

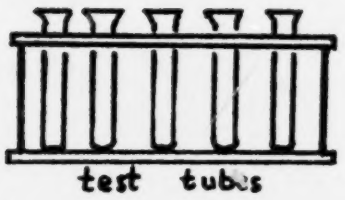
SKIP THE NEXT BLANK PAGE.

So we have some new ideas for two parts of a golf bag. By using this "checkerboard," we can join these new ideas together. We put the new ideas for shape part on the top. The ideas for the material part are on the side. In the squares the ideas are joined together.

KINDS OF MATERIAL	SHAPE: TRIANGLE	TEST TUBE	CANNON	OCTUPUS	GARBAGE CAN	ROUND
STRAW	triangle shaped, straw g. bag	test tube shaped, straw gb	cannon shaped, straw, gb	octopus shaped, straw, g bag	garbage can shaped, straw gb	round shaped, straw, gb
WOOD	triangle shaped, wood g. bag	test tube shaped, wood	cannon shaped, wood	octopus shaped, wood	garbage can shaped, wood	round shaped, wood
SILK	triangle shaped, silk, gb	test tube shaped, silk	cannon shaped, silk	octopus shaped, silk	garbage can shaped, silk	round shaped, silk
FISHNET	triangle shaped, fish-net g. bag	test tube shaped, fishnet	cannon shaped, fishnet	octopus shaped, fishnet	garbage can shaped, fishnet	round shaped, fishnet
RUBBER	triangle shaped, rubber gb	test tube shaped, rubber	cannon shaped, rubber	octopus shaped, rubber	garbage can shaped, rubber	round shaped, rubber
CARD-BOARD	triangle shaped, card-board gb	test tube shaped, cardboard	cannon shaped, cardboard	octopus shaped, cardboard	garbage can shaped, cardboard	round shaped, cardboard
GLASS	triangle shaped, glass gb	test tube shaped, glass	cannon shaped, glass	octopus shaped, glass	garbage can shaped, glass	round shaped, glass

Notice that some squares have: a wooden, garbage can shaped golf bag, a cardboard, test tube shaped golf bag, a rubber, octopus shaped golf bag, and many others. In fact we have 42 new ideas for golf bags. There are 42 squares in this checkerboard. Each square gives us a new idea.

Some of the ideas may be good ones. A test tube shaped, cardboard golf bag may be good. It would not cost much, and it would be light weight.



Another idea from the checkerboard is an octopus shaped, golf bag made of rubber. This is very different from most golf bags. Maybe this idea sounds silly or stupid. But think about the arms of an

octopus and how they hold things. Each arm of an octopus shaped golf bag could hold one or two golf clubs.

The rubber arms would wrap around the golf club. Some people might buy a silly golf bag like this.

Our golf bag problem uses only two parts, shape and material. We could try to change other parts of a golf bag too. (Some other parts might be "the-way-the-bag-is-carried," color, size, "the-pockets-for-holding-things" and others.) Then we would have many more ideas when we joined them all together.

Now let's try to invent some new kinds of breakfast foods. This time we will change four parts instead of two (as we did with the golf bag). Four parts of breakfast food are: shape, flavor, color, and size. Here are some changes for each part:

Look at the checkerboard again. There are other kinds of octopus shaped golf bags. There are octopus shaped bags that are made from wood, cardboard, straw, silk, and other materials. Rubber seems to be the best material for an octopus shaped golf bag though. Rubber can best hold golf clubs.

Remember, only some of the ideas from a checkerboard are good ones. Others are not good. A good idea is both new and useful.

Here is why the checkerboard is helpful: It joins together all new ideas for two parts.

Shapes	Flavors	Colors	Sizes
numbers	chocolate	green	dime sized
boats	fruit	red	stamp sized
people	vegetable	blue	tiny

By joining together changes from each part, do you know how many ideas we have? Make a guess and write it here.

We have 81 new ideas! Here is how we get the number 81. We start out with one idea for a new breakfast food that is shaped like numbers, chocolate flavored, green, and dime sized. Here is a second idea: Shaped like numbers, chocolate flavored, green, and stamp sized. Notice that only the size was changed. Here are ideas number three and number four: Shaped like numbers, chocolate flavored, green, and tiny; Shaped like numbers, chocolate flavored, red, and dime sized. We are only changing one part at a time. If we do this for all of the changes written on page 21, we will have 81 ideas for new breakfast foods.

(b) Here is another good idea taken from the 81: number shaped, chocolate flavored, blue colored, and dime sized. This food could help children learn to count. The chocolate would make it taste so good, they would like learning to count.

(a) and (b) are good because some of the new part ideas kind of "go together." Boat shaped goes with fruits that float since boats float. Number shaped goes with chocolate because we want children to enjoy learning about numbers.

Some of the 81 will be good ideas for new breakfast foods. These may be some: (a) boat-shaped, fruit flavored (apples, watermelons, cranberries), red colored, and stamp sized. Since apples, watermelons and cranberries float, they would be good boat ideas. Any color would be all right, but we would probably want to use one of the larger sizes such as stamp-sized.

A new breakfast food like this would be fun for children.

Many of the ideas won't go together very well. Some of them will probably go together better than (a) or (b).

Now it's your turn. Try to add some new part changes to each of the parts shown on the next page.

Shapes	Flavors	Colors	Sizes
numbers	chocolate	green	dime sized
boats	fruit	red	stamp sized
people	vegetable	blue	tiny
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

A look back . . .

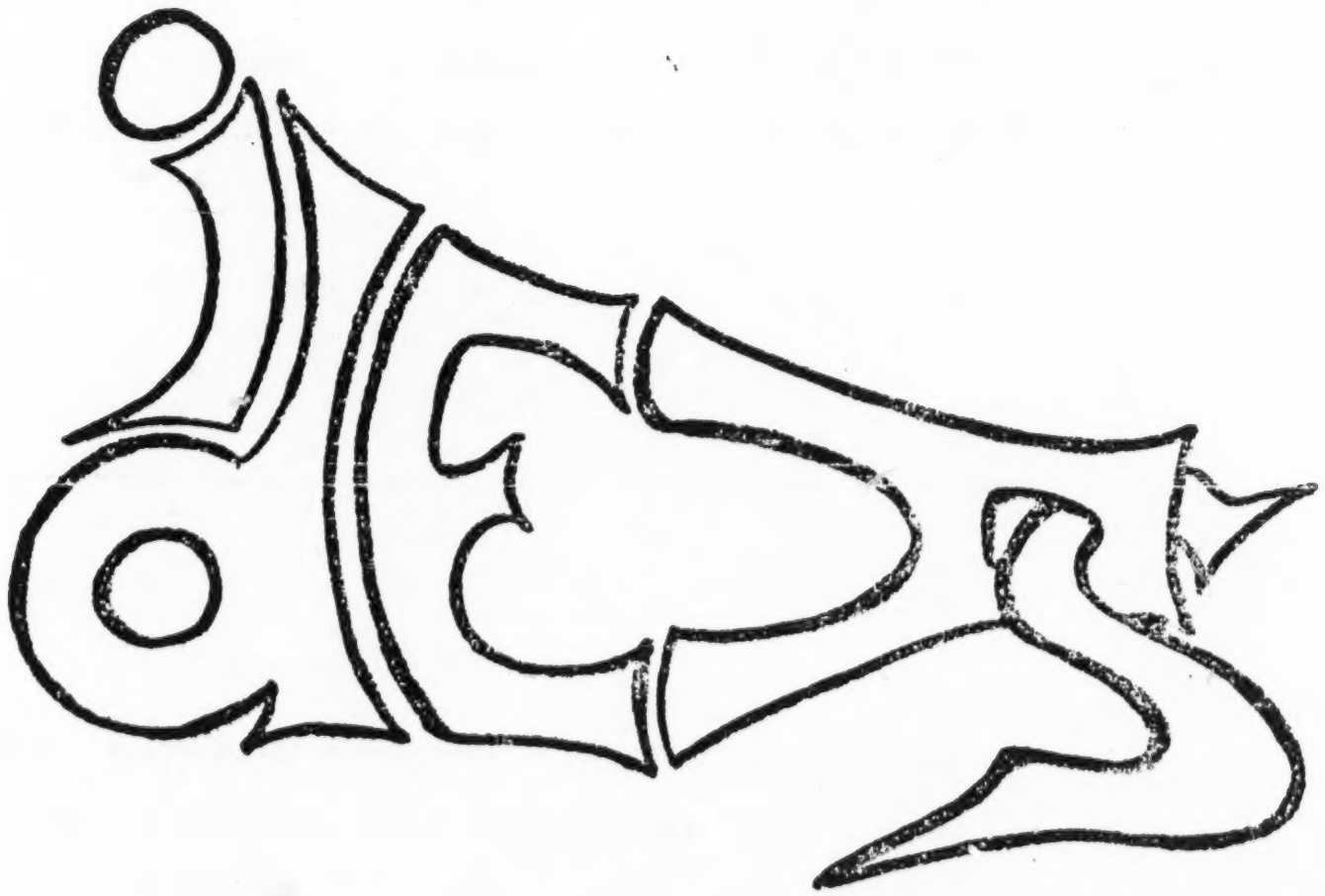
Almost everything has parts, and parts can be changed. Changing parts is a good way to improve things. Changing parts also helps you invent new things.

A checkerboard helps you join new part ideas together.

Some of the ideas from the checkerboard will be good ones.

On this page write some of the best ideas you get from joining your part changes together.

PERSONAL ANALOGY BOOKLET



This book is about ideas. When you finish reading it, you will know how to think of more good ideas. Here is why you will be able to think of more good ideas:

You will know that pretending helps you. So does comparing things, especially things that are not usually found together.

You should have fun reading the book and thinking of ideas.

Now you will read about maple tree seeds for a while. A maple tree seed grows on a maple tree. Then it falls and grows in the ground. Soon a little maple tree pops through. This is what a maple tree seed looks like. Sometimes two of them are joined together; other times they are not joined together.

How is a maple tree seed like a fire extinguisher? A rattlesnake like a missile? A crystal like an apartment building? Try to think of an answer to each of these questions. You'll find out more about them later.

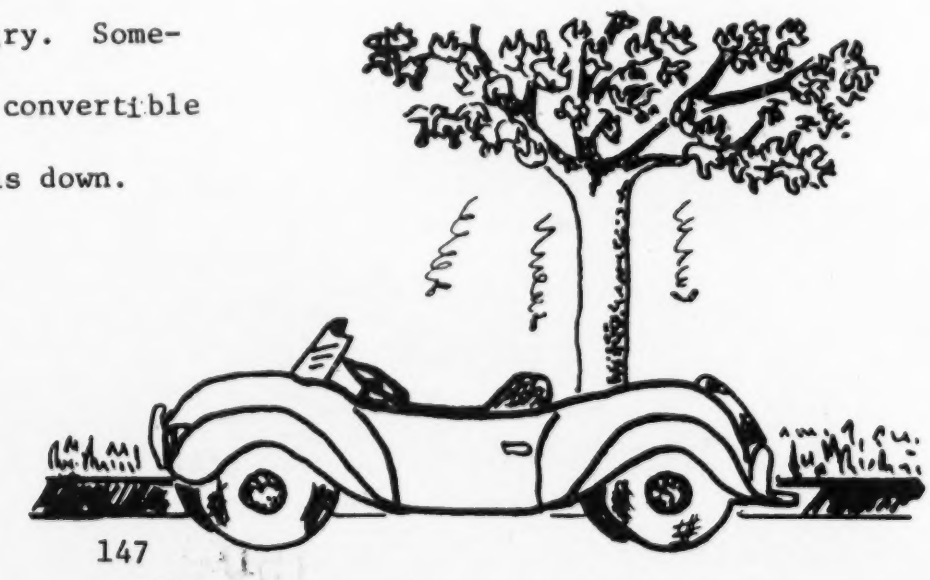
_____

_____

_____

Believe it or not, these are helpful questions. They can help you look at things in new ways.

Maple tree seeds can make a mess. They might fall on a clean car. Sometimes they make a tinging noise when they hit the car. This could make the car's owner angry. Sometimes they land in convertible cars when the top is down.



How else can **maple** tree seeds bother people? Try to think of one or two ways. Write them here.

So, maple tree seeds are needed to make maple trees, and they can bother car owners. But they can also be fun.

How else might maple tree seeds be fun? Write your ideas here.

Sometimes maple tree seeds land on sidewalks. Hundreds of them can almost cover a sidewalk. People step on them. The seeds then make a little popping noise. Stepping on them can be fun. It's like hearing dry leaves rustle or snow crunch.

Let's talk about their falling from the tree. They don't float down. They don't fall like a rock. They spin around and around. Not many other seeds spin like this. Maple tree seeds have an interesting fall from the tree

Some people have carefully studied falling maple tree seeds. They also have made models of them. The models are plastic and look like the real seeds. They also fall like the real seeds. The plastic seeds are bigger though.

One part of the plastic seed is filled with a special powder that puts out fires. The sacks are dropped from airplanes which fly over forest fires. The sacks open automatically just before they hit the ground. Then the seeds spin toward the hottest part of the fire. The plastic melts, and the powder helps put out the fire.

But how did the inventor of the plastic seed get the idea? How did he connect maple tree seeds with fire extinguishers?

> He explains it like this. "I looked at the maple tree seed in a new and different way. Just for fun I pretended I was a maple tree seed. I first pretended I was in the tree. Then I fell, spinning and swirling. Later I pretended I was on the ground. I learned a lot about maple tree seeds from doing this.
>
> "The falling and spinning was the best part. I pretended I was falling and spinning down from high places. I pretended I could swoop down on animals and attack them. Then, all of a sudden, I thought, 'This might be a way to attack forest fires too.' (I had been trying to think of fire fighting ideas for a few days. I work for a chemical company. The company wants to sell some fire fighting powder. My idea was the answer.)"

The plastic maple tree seed does not look like a regular fire extinguisher. Maple tree seeds and regular fire extinguishers can do the same job though. Don't you agree now?

Everyone doesn't think like this inventor. He pretends a lot in order to look at many things in new ways. He sees common everyday things in new ways. Many inventors pretend a lot.

You can learn to think this way too. Let's give it a try.

Pretend you are an animal. Choose one from the list below or pick one of your own. Write what it is like to be this animal.

turtle	owl	pig
spider	worm	flea
termite	butterfly	swordfish

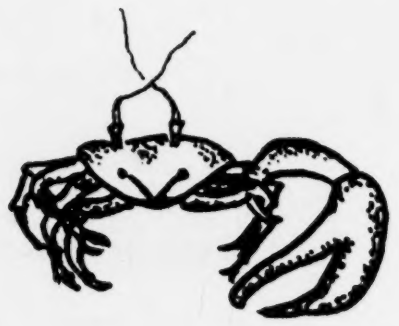
Start writing here.

Go on to next page.

Here is how another student might do it.

Teacher: "John, pretend that you are a fiddler crab."

Student: "I would be hard on the outside because of my shell, and soft on the inside . . . I would have special little creases on my claws to grip and teach things, and one of my claws is twice as big as the other."



Was your description like this one? Did you talk about what the animal looks like?

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Student: "I would be hard on the outside because of my shell, and soft on the inside . . . I would have special little creases on my claws to grip and teach things, and one of my claws is twice as big as the other."

Was your description like this one? Did you talk about what the animal looks like?

Write more about your animal here.

Let's look at another example.

Teachers: "Joyce, how about pretending that you are a fiddler crab?"

Student: "I would be pretty busy getting food for myself, but I've got to be careful not to be food for a big fish. I've got to be careful not to get caught, but I must take some chances or the other crabs will beat me to it and I'll starve."

Joyce's description tells more than John's. Joyce gives more than a description of facts.

Peter's description is better than either John's or Joyce's. Here it is.

Teacher: "Peter, imagine that you are a fiddler crab."
Student: "O. K. I'm a fiddler crab. I've got armor all around me--my tough shell. You'd think I could take it easy, but I can't. And that big claw of mine! Big deal! It looks like a great weapon, but it's a nuisance. I wave it around to scare everybody, but I can hardly carry it. Why can't I be big and fast and normal like other crabs? No kidding! That claw doesn't even scare anyone!"

Peter really pretends he is the crab. He tries to see and feel things just as the crab would. He kind of "got into" the crab and looked out at world through a crab's eyes. He saw (and felt) things differently than before.

Now try to write about your animal again. Pretend you are inside him, or pretend you are him. If you want to change to a different animal, that is O. K. Don't write about a crab though.

Go on to next page.

Notice these new and different things Peter said about the crab: (a) The crab is tough looking, but also afraid. (b) The crab's claw looks like a powerful weapon, but it can also be a bother. (c) The crab looks strong, but he doesn't scare anyone.

Peter's description is much better than the others. It is better because Peter tries to see the crab in a new and different way . . . from the inside of the crab, as the crab might see himself. Go back and read again the descriptions written by John, Joyce, and Peter. Notice how Joyce does a better job than John, and how Peter's writing is the best of all.

Here is another page to write on.

Your second try is probably better. Isn't it easier when you pretend to get inside the animal?

Next we will talk about another student who pretends. Her name is Harriet. She pretends that she is the mud where a crab lives. Harriet and Peter are both good pretenders. Harriet's job may be harder though, because she pretends that she is a non-living thing.

Pretending you are something that isn't living is a very different way of looking at something. Harriet did an excellent job of pretending she was the mud. She almost became the mud. Because of doing this, Harriet learned a lot about mud and fiddler crabs.

Harriet thought about mud in a new and different way. It's like looking at a falling maple tree seed and thinking of how it, or something like it, could help to put out fires.

Teacher: "Harriet, imagine that you are the mud in which the fiddler crab makes his home."

Student: "I have the feeling that no one cares if I'm here or not. I'm full of holes into which the crabs crawl at night. They never thank me. I'm mud; that's all. I'd like to do something to make the crabs thank me. After all, if it were not for me, those crabs would get eaten up in one night."

Teacher: "How might you make the crabs thank you?"

Student: "I wonder if I could seal myself up behind the crabs when they crawl in me. That would give them protection. The darn thing is that I try to move, but I can't. When I see a crab about to be eaten by a striped bass, I want to flow out and wrap around the crab and save him . . . but I can't."

We often discover new connections between things when we think about them in new and different ways.

Maybe you see the connection between a porch on a house and a belly on a fat man. Try to write about how they are alike.

Think about these other things that are not usually thought of together: After each question, write how the two things are alike.

1) A car's wheel and the cutter on a wall can opener.

2) A snake and a winding river.

3) A dark cave and a tooth's cavity?

4) A stapler and an alligator?

5) A lion's head and a flower?

Let's not forget rattlesnakes and missiles, crystals and apartment buildings, or maple tree seeds and fire extinguishers. By the way, rattlesnakes are very good at knowing when warm things (like mice) are near. Someone connected this idea to missiles. Now we have missiles (called "sidewinders" after the sidewinder rattlesnake) that follow the heat coming from a jet plane.

Crystals are regular shaped patterns or shapes that make up minerals. Buildings are being made that have shapes like the crystals.

6) A typewriter and a machine gun?

7) Meat in a sandwich and floors in a building?

8) Moss on a tree and paint on a house?

9) A snow shovel and an eraser?

10) A flashlight and a hearing aid?

Many inventors compare things in new and different ways. One inventor wanted to build underwater tunnels, but he didn't know how to do it. Finally, he watched a ship worm digging into a piece of wood. Watching the shipworm led to a solution of his problem. The shipworm built a tube for itself as it moved forward.

An idea for a new kind of toothbrush came from cockleburrs. These are the spiny, ball shaped weeds that sometimes stick to clothing, dogs, and other things. The cockleburr is difficult to remove. It can be pulled off only in one direction. Inventors have used the same idea for new and better toothbrushes. These toothbrushes have a cushion or "pillow" filled with tooth powder. The cushion is removed each time the teeth are brushed. The cushion can be pulled off in only one direction. It will not fall off when the teeth are being brushed. This kind of toothbrush, the inventor says, doesn't become a home for tooth destroying germs. Ordinary toothbrushes have many little living things in them.

Inventors have used other comparisons too. Study of ears resulted in the telephone. Dark leafed flowers led to improved fuel. Paint improvements could come from lichens (a simple form of plant life).

Now you think of some things that are not usually together, but really are alike in some way. In other words, try to think of pairs of things that go together in a new and different way.

Write on the next page.

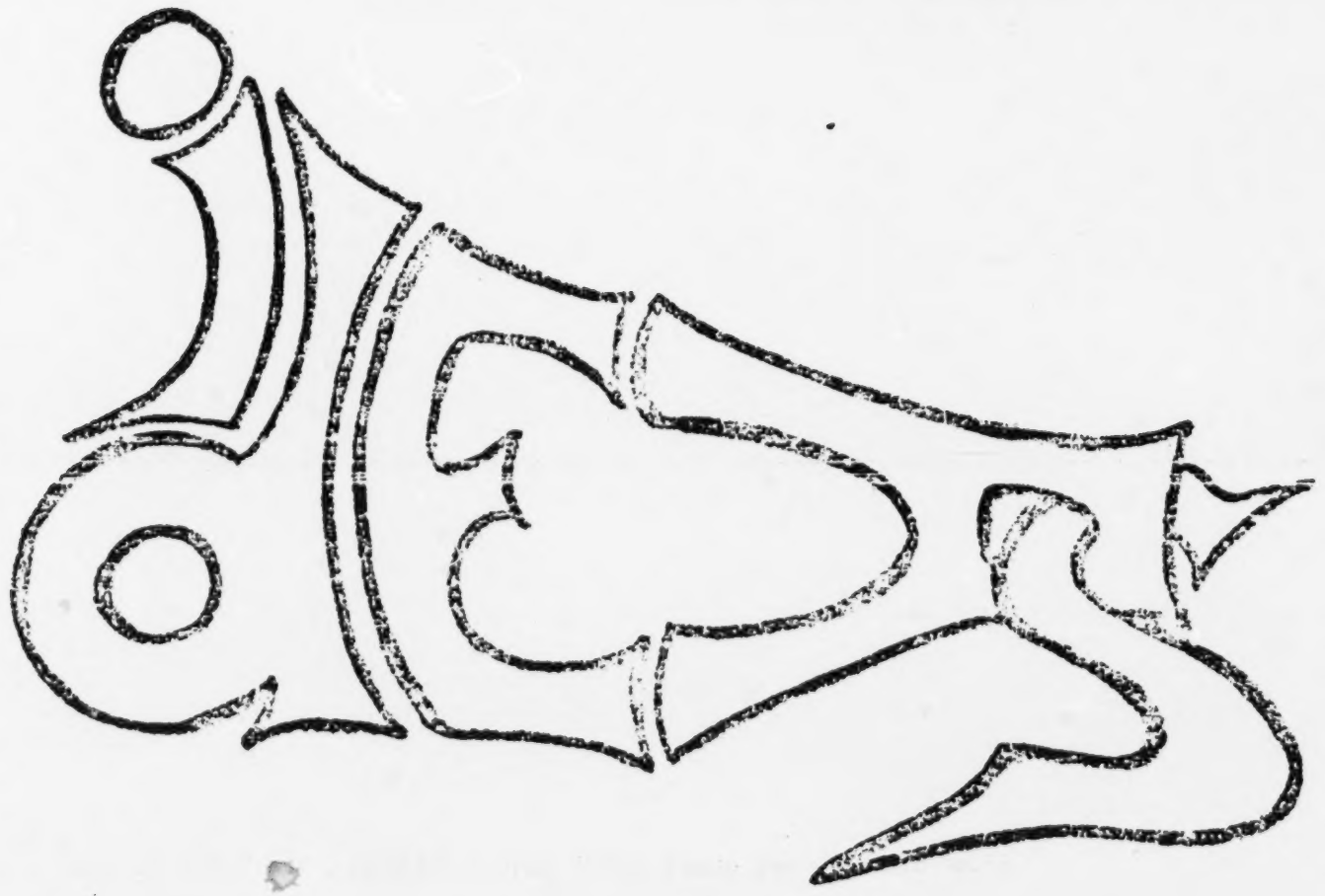
A look back . . .

You can think of new and better ideas by looking at things in new and different ways. Pretending a lot is a big help. So is comparing things that are not usually found together.

New and different comparisons make the world seem more alive and interesting.

If you choose your own comparisons, you are using what you already know to think of new ideas.

CONTROL BOOKLET



Here are some stories written by children. The endings have been left out. You try to finish them. In other words, make up an ending for each story.

"Slow down!" demanded Lori Lou. "First, we have to get permission, seeds, a place to have a garden, and a place to have a stand. . . ."

After Lori and her friends had kept the vegetable stand in business all summer and on Saturdays in the fall, they began to notice some of the vegetables were missing each morning before they arranged them. Lori Lou noticed it first.

The Road Stand Mystery

Lori Lou walked in silence beside her friend Janet Jenkins. She was trying to plan some kind of summer adventure. Thinking aloud she said, "What can we do this summer?" As she spoke, Janet's brother Bobby came up. He jokingly said, "Let's build a roadside stand."

"That really isn't a bad idea," commented Lori.

Then Bobby said, "I have some wood to make the stand."

"Lori Lou and I can raise vegetables to sell," suggested Janet who was a real outdoor girl.

Then, speaking like a well trained detective, Bobby said, "Look, he must not like cabbage and pumpkins. None of them are missing." Lori Lou, Janet, and Bobby carefully checked to make sure he was right.

Now the children had a real mystery. . . .

What happened? You finish the story. Here are some pages where you can write.

Here is another story.

The Troll's Party

Snowdrop was to go to the troll's party. As she struggled to put on her new costume, she noticed something being pushed under the door. It was a note. She knelt to pick it up. She read it aloud, although there was no one to listen to her. It read like this: "I would like you to come to my party instead, 7:00 to 9:00 p.m. Your good friend, Stumpy Pirate". . . .

Now it's your turn.

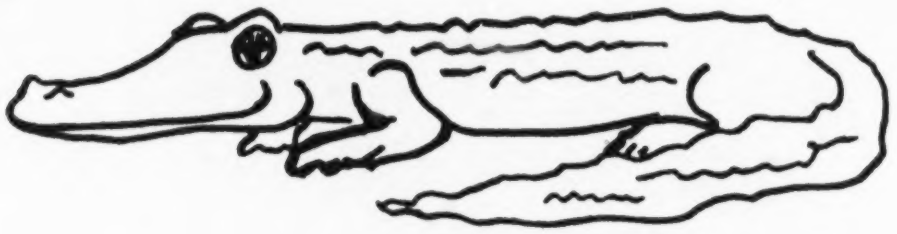
6

8

One day Pete went looking for adventure. On the way he met Esmeralda taking a sunbath. She decided to go with him. They planned to raid Rabbit Den No. 5. When they arrived, the place was a shambles and there were signs of struggle.

Adventures of Peter Crocodile

Peter was a young crocodile with a green scaly skin. All the other crocodiles thought his coat was very beautiful. He liked it too.

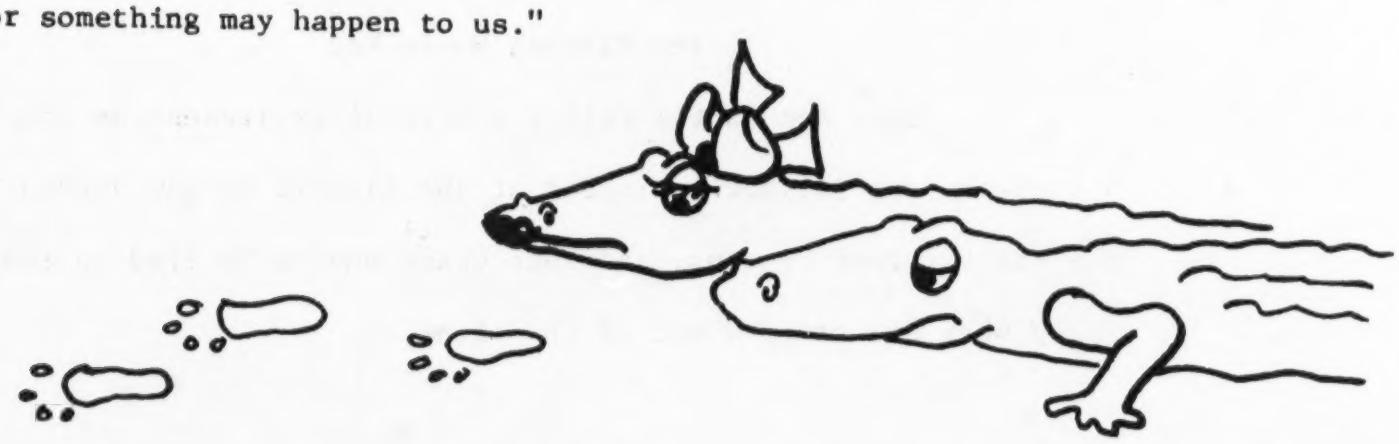


Peter Crocodile was better known to all his friends as Pete, the Croc. Pete's mother, father, and sister were known as Ma, Pa, and Sis Croc. But Pete's girl friend had a long name--Esmeralda! All the crocodiles lived in Musk Swamp.

"Gee," said Pete, "I wonder what happened?"

"Tracks!" said Esmeralda. "Let's follow them."

"Okay," said Pete, "But we had better be very careful or something may happen to us."



After awhile the two crocodiles saw the enemy ahead.

Finish the story.

The Missing House Key

Peggy Ann Barton felt a shiver of excitement as the big jet plane from California landed at the airport in New Jersey. She saw her four cousins, and Aunt Grace and Uncle Fred in the crowd when she stepped out of the plane.

They exchanged greetings and started home. By the time Uncle Fred stopped the car at their house, Peggy was busy telling the children about her trip. Suddenly, she heard Aunt Grace say, "Oh no, not again!" She was fumbling under the porch mat.

"What's the matter, Mom?" shouted Roy in a loud voice.

"I can't find the key. Have you children taken it away?"

"I didn't," replied Patty and Donnie and Francis quickly.

"Maybe it will turn up again some place," said Aunt Grace.

"That happened last time," Peggy heard Uncle Fred say as he took his key and unlocked the door. Peggy forgot about the missing key until she heard Aunt Grace calling later in the day, "Look, I found a coin but no key under the mat."

"It looks like the coin that disappeared from my collection last week," Roy told her. "I wonder how it got here."

Later Uncle Fred told Peggy someone had been taking the key and putting something else there. . . .

You make up an ending.

Pudgy the Cat

One day Pudgy the cat was sleeping upon her bed of dried leaves in the hollow of an old oak tree. Suddenly she awoke and yawned drowsily. The birds were singing merrily way up high in the trees, and the morning sun was peering through the leaves of the trees in the forest.

Pudgy decided that she was hungry, so she walked over to the berry bushes, knocked some on the ground, and began eating.

Then Pudgy was thirsty. She strolled over to the babbling brook behind the old oak tree and sipped some cool, fresh, brook water.

While Pudgy was sleeping, a little fawn and its mother appeared by the brook for a sip of cool water. They pranced away frightened when they heard the commotion behind them. Three fuzzy cats, Me, My, and Mo appeared. . . .

It's your turn to finish the story.

Suddenly, ker-plop! Pudgy fell into the ice-cold water. She squealed out in vain for help, but no one came to her rescue. She finally reached shore after swimming for what seemed like hours. Slowly she crawled out of the water and stumbled to her bed of soft dry leaves. She fell into a deep sleep.

Appendix C

Procedural Instructions

Read to Ss

I'm Mr. Warren and this is Mr. Belcher. We work at the Research and Development Center in Madison. The Research and Development Center is a place where people study children and how they learn. We are trying to find out more about how children think of new ideas. Students like you help us do this. What you will be doing today is part of an experiment.

A. (Read when Controls with Booklets are present).

Some of you will receive a little book to read. A few of you won't read any book. After awhile all of you will do some exercises and answer some questions. It is important for you to know that we are mainly interested in seeing how well the books can teach you about ideas. In other words, the books are being tested, not you. Each of you may wonder, "Why did (didn't) I get a book, when other students did not (did)?" We chose you just like drawing names out of a hat. You all had the same chance of getting a book or not getting one (CWOB Ss are dismissed at this point).

B. (Read when only Booklet Ss are present).

Here is what will happen today. Soon we will pass out one little book to each of you. You will be asked to read the book carefully and do the written exercises in it. Although the covers on all books are the same, the insides are not the same. There are many different books, all with the same cover but with different writing inside.

When you finish reading the book, you will do some exercises and help us by answering some questions. It is important for you to know

that we are mainly interested in seeing how well the books can teach you about ideas. In other words, the books are being tested, not you. Later on this morning (afternoon) you will have a chance to use what your book teaches you (A statement to this effect was repeated by E once during the reading of the booklets).

Do you have any questions before we hand out the books?

(After the booklets were handed out, the following comments were read)

Some important things to remember are: (1) Do <u>not</u> try to race through your book, reading and writing at top speed. It is <u>much</u> more important for you to read carefully. (2) Do as well as you can on the written exercises, but remember, <u>all of your answers will be correct</u>. <u>It is impossible for you to be wrong</u>.

Some of you will finish before others. One reason for this is that you are reading different books, and some books may take longer to read than others. If you do finish early, go back and check over your work. Then sit quietly. If you are still working and you see other people who have finished, <u>do not think that you must rush to finish too</u>. Remember, it is much more important for you to read carefully and do the written exercises. We will work on the books for about an hour.

Appendix D

Warren and Davis Distant

Linking Exam

(WADDLE)

Name: _____
LAST FIRST MIDDLE

School: _____ Sex: _____
(M or F)

City: _____ State: _____

Grade: _____ Teacher: _____

Age: _____ Date of Test: _____
Yr. Mo. Day

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1.	diaper	bottle	born	baby	1.
2.	pillow	drowsy	deep	sleep	2.
3.	lock	close	knock	door	3.
4.	loaf	toast	flour	bread	4.
5.	yell	child	tear	cry	5.
6.	imagine	pillow	bad	dream	6.
7.	castle	majesty	rule	King	7.
8.	street	hall	square	town city	8.
9.	frigid	sneeze	shiver	cold	9.
10.	king	cub	fierce	lion	10.
11.	ten	gloves	nail	finger	11.
12.	step	sore	shoes	foot	12.
13.	digest	intestine	growl	stomach	13.
14.	shrill	policeman	dog	whistle	14.
15.	traffic	motor	roads	car auto	15.
16.	patient	office	ill	doctor	16.
17.	green	cottage	cracker	cheese	17.

18.	top	goat	peak	mountain	18.
19.	store	string	shine	shoe	19.
20.	brains	cabbage	hunter	head	20.
21.	Roman	digits	figures	number	21.
22.	cottage	dog	building	house	22.
23.	tin	officer	guard	soldier	23.
24.	pickle	unsweet	grapefruit	sour	24.
25.	America	eye	hawk	eagle	25.
26.	people	husband	dad	man	26.
27.	globe	quake	sky	earth	27.
28.	sheet	hear	dance	music	28.
29.	city	sign	pavement	street	29.
30.	sea	shaker	eat	salt	30.
31.	corner	inch	dance	square	31.
32.	post	bright	chair	lamp	32.
33.	time	elephant	past	memory	33.
34.	creepy	fly	monkey	spider	34.

INSTRUCTIONS

You will be given three words. Your job is to find a fourth word which goes with all three. Write this word in the space at the right.

For example, what word do you think goes with these three:

Example A: right fist shake _____

The answer is "hand." We have a right hand; a hand can be made into a fist; and "hand" is part of the word "handshake."

Let's look at another one.

Example B: flowing creek Amazon _____

In this case the correct word is "river." A river is usually flowing; it is like a creek in many ways; and a well-known river is the Amazon.

Here are a couple more.

Example C: rest mattress time _____

Example D: hot apple wagon _____

Many of the items that follow are not easy and you will have to think about some of them for a while. Others will be easy. If you have trouble with some groups of three, go on to the next and come back to them later. Give only one answer to each item.

Appendix E

Attitude Questionnaire

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NAME _____ SCHOOL _____

QUESTIONS ABOUT THE BOOK YOU READ

For each question put an X in the line that tells how you feel about the book. Be as accurate as possible.

	Strongly Agree	Agree	Disagree	Strongly Disagree	
1. The sentences were too long.	_____	_____	_____	_____	1.
2. Many words were new to me.	_____	_____	_____	_____	2.
3. It was easy for me to do the writing.	_____	_____	_____	_____	3.
4. The writing was fun to do.	_____	_____	_____	_____	4.
5. I could read the book easily.	_____	_____	_____	_____	5.
6. I became tired before finishing.	_____	_____	_____	_____	6.
7. The book was too long.	_____	_____	_____	_____	7.
8. The book was too hard to read.	_____	_____	_____	_____	8.
9. The pictures made the book more fun to read.	_____	_____	_____	_____	9.
10. The book was too easy.	_____	_____	_____	_____	10.
11. I enjoyed reading the book.	_____	_____	_____	_____	11.
12. I enjoyed writing my own ideas.	_____	_____	_____	_____	12.

Appendix F

Summed TTCT Scores and WADDLE

Scores for School x Sex

x Treatment Cells

Summed TTCT Scores and WADDLE Scores for School x Sex x Treatment Cells[1]

Schools	Sex	Treatment: Checklist	Free Association	Parts	Personal Analogy	Control w. Booklet	Control w.o. Booklet	Averages: Rows	Schools
	Females	75.5 16.0	84.0 20.5	74.5 19.0	74.5 16.0	52.0 19.0	64.0 17.0	424.5 107.5	
School 1									691.2 202.3
	Males	40.5 16.0	42.0 16.0	49.0 17.0	52.0 14.5	25.5 11.0	57.7 20.3	266.7 94.8	
	Females	57.0 18.2	67.8 17.2	83.3 17.8	63.7 15.5	77.7 18.2	60.0 13.5	409.5 100.4	
School 2									752.2 194.5
	Males	43.3 18.5	68.2 13.8	61.4 14.2	69.5 14.8	60.3 18.0	40.0 14.8	342.7 94.1	
	Females	78.0 21.5	45.3 22.3	52.5 13.5	57.5 22.5	35.0 23.0	79.0 22.0	347.3 124.8	
School 3									784.3 221.2
	Males	82.5 18.5	78.5 13.5	71.0 14.5	62.3 17.7	89.7 14.7	53.0 17.5	437.0 96.4	

Summed TTCT Scores and WADDLE
Scores for School x Sex
x Treatment Cells[1]
(continued)

Schools	Sex	Treatment						Averages	
		Checklist	Free Association	Parts	Personal Analogy	Control w. Booklet	Control w.o. Booklet	Rows	Schools
	Females	210.5 55.7	197.1 60.0	210.3 50.3	195.7 54.0	164.7 60.2	203.0 59.5	1181.3 332.7	
Column Averages									
	Males	166.3 53.0	188.7 43.3	181.4 45.7	183.8 47.0	175.5 43.7	150.7 52.6	1046.4 285.3	

[1]Top number in each cell is summed TTCT score. Bottom number is WADDLE score.

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